RECORDS
RAYMARK
3.6
11617

APPENDIX F

HUMAN HEALTH RISK ASSESSMENT SUPPORTING DOCUMENTATION

Human Health Risk Assessment

APPENDIX F - Human Health Risk Assessment

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Appendix F.1

Correlation of Copper and Lead
Field Screening Data vs. Fixed Lab Data

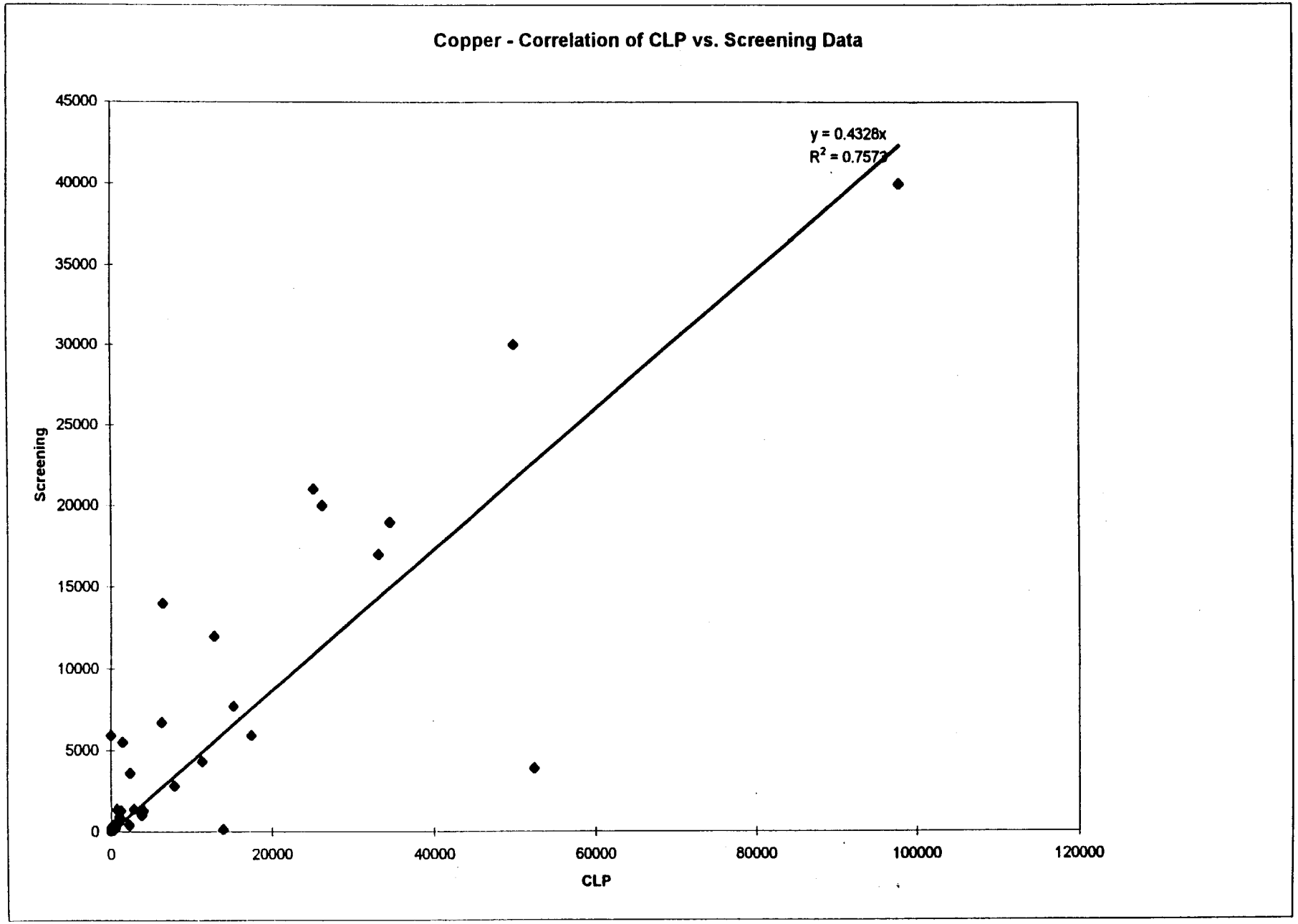
Appendix F-1
Field Screening – CLP Data Correlation

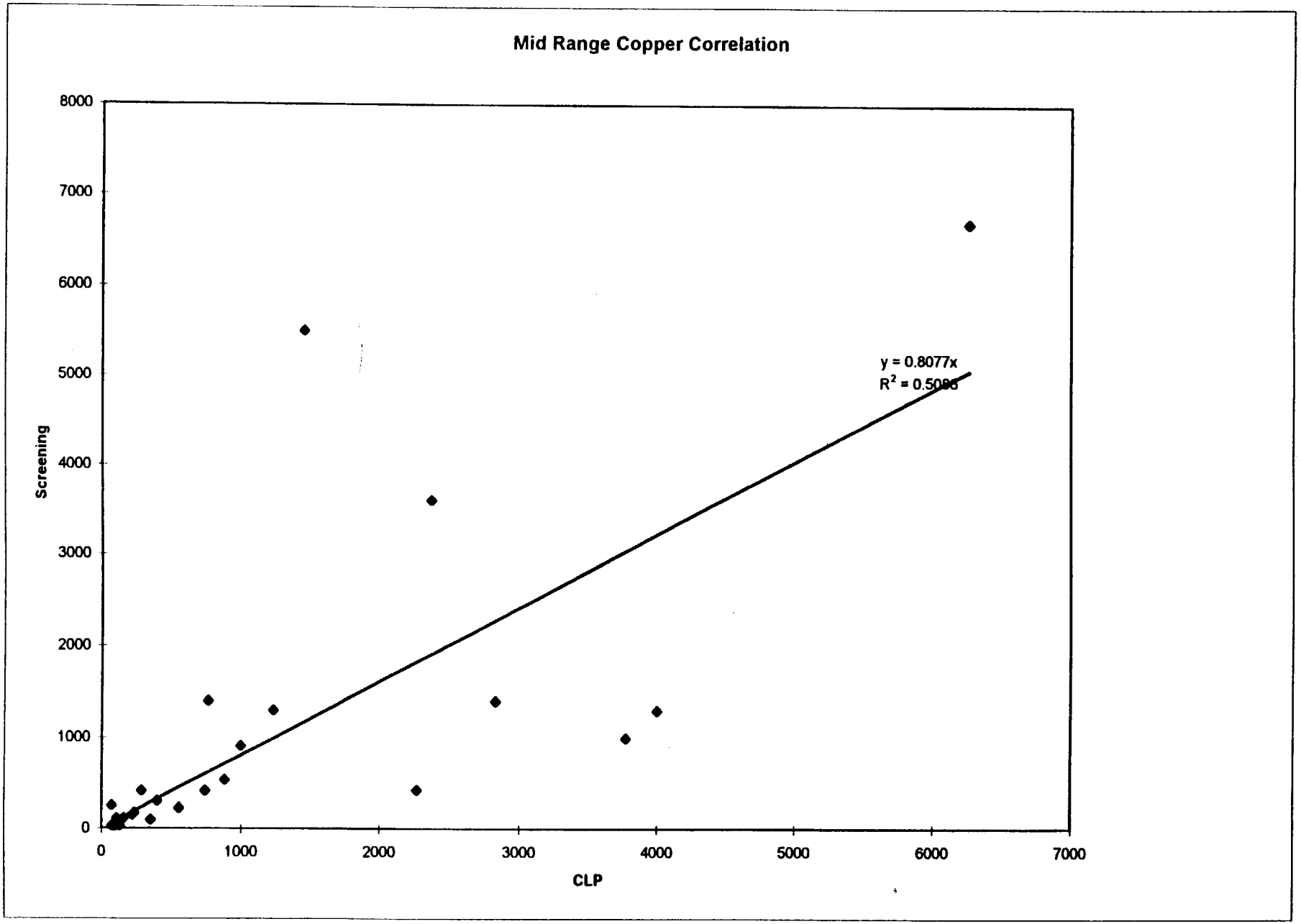
EPA directed Brown and Root Environmental to determine the correlation between data analyzed by field screening and CLP methodologies at the Raymark – Ferry Creek site. A strong correlation would allow for the use of field screening data in quantifying risk at the site. Two statistical procedures were used to determine the correlation between data analyzed by field screening and CLP methodologies: linear regression, which evaluates the correlation on a point-by-point basis; and a nonparametric t-test, which compares the means of two data sets for each method. Paired data selected for the correlation determination were collected at the same location and same depth.

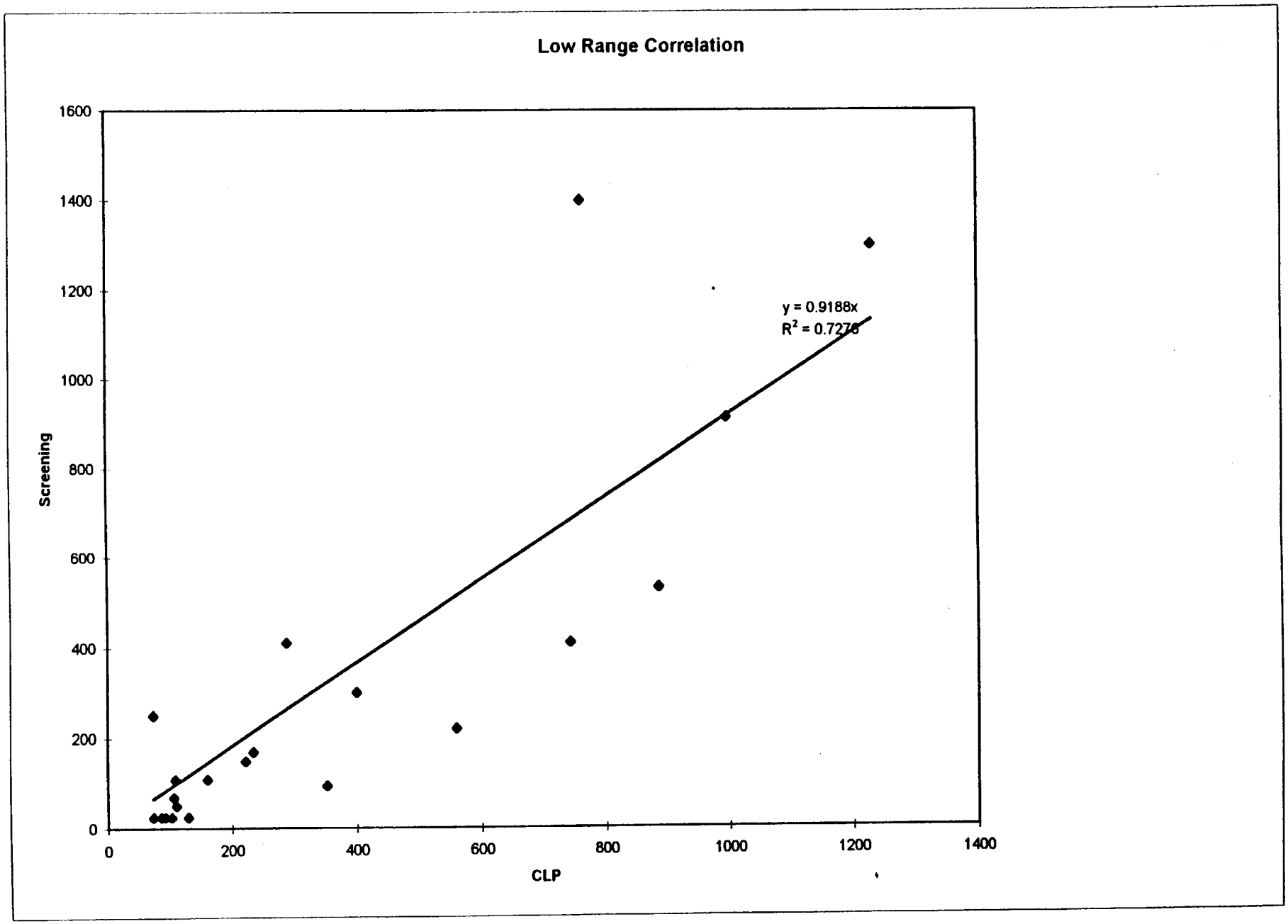
For the first statistical analysis, a scatter plot of paired data was generated for each chemical with the field screening results plotted along the x-axis and the CLP results plotted along the y-axis. A linear regression was then performed on the scatter plot and a correlation coefficient was generated. For data that are strongly correlated, the scatter plot will exhibit a linear relationship with a correlation coefficient (r) of slightly less than 1. The copper and lead data had relatively high correlation coefficients of 0.87 and 0.86, respectively. The PCB data had extremely low correlation coefficients. The PCB scatter plots show that some correlation exists at low concentrations (< 1 ppm), but that this correlation weakens as concentrations increase. This may be due to the narrower calibration ranges of the field screening techniques.

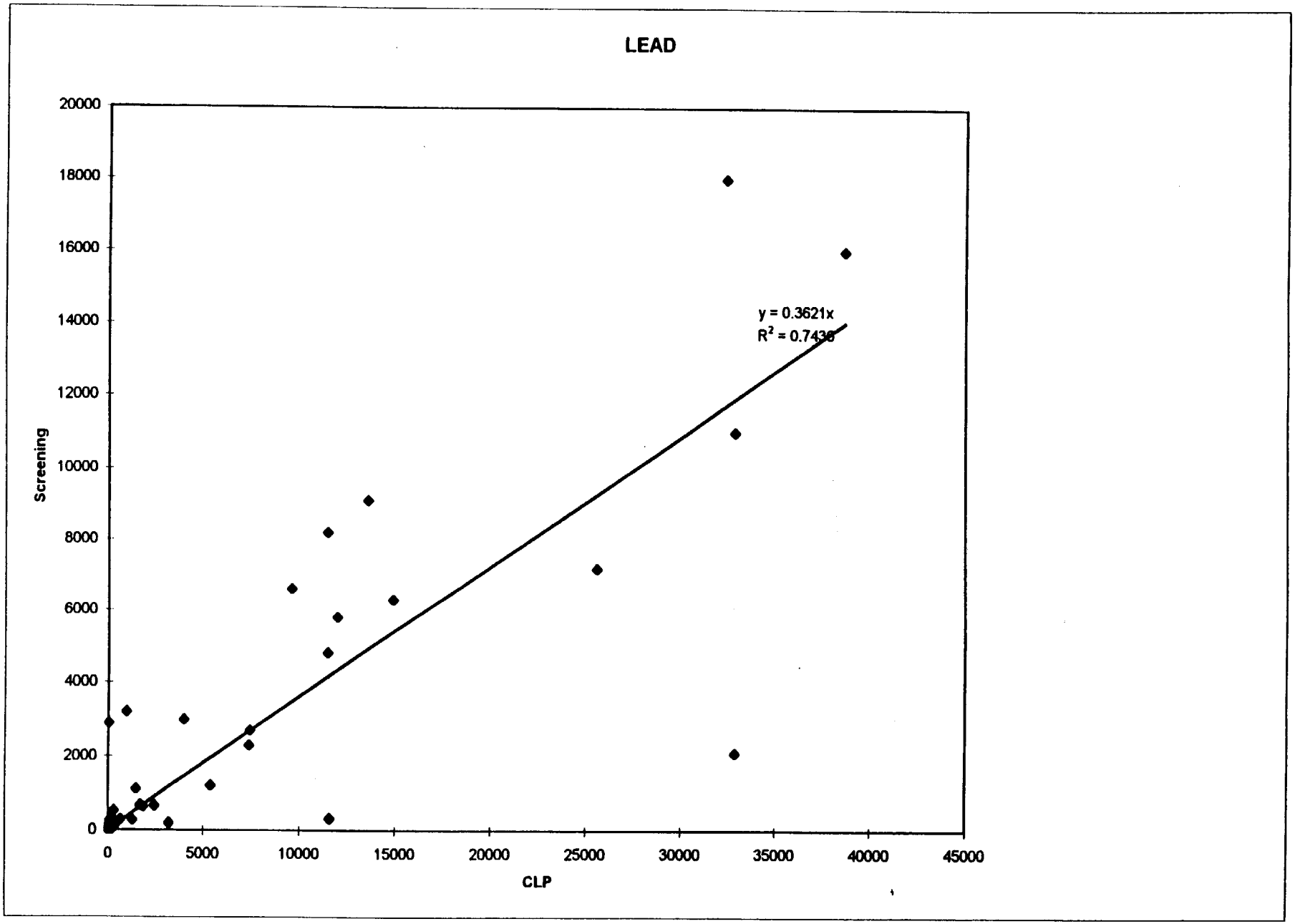
For the second statistical analysis, the field screening data was grouped into one population and the CLP data was grouped into a second population. The Wilcoxon Rank-Sum (WRS) test, a distribution-free or nonparametric t-test, was performed on the two populations to determine whether their means were statistically equivalent. The copper and lead data had statistically equivalent means; the PCB data did not.

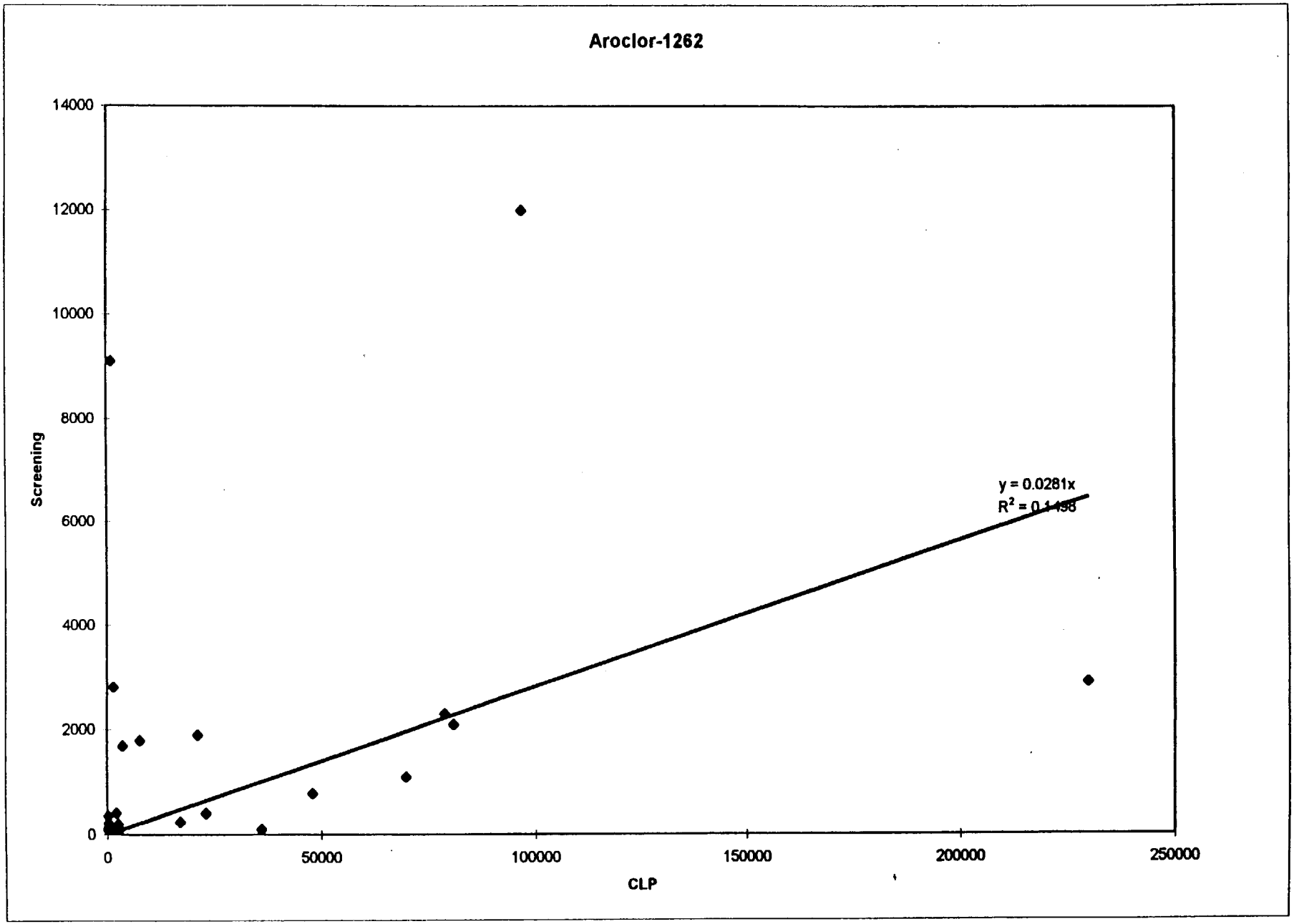
Based on the results of the two statistical analyses, the use of field screening data to quantify risk at the site is acceptable for copper and lead, but not for PCBs

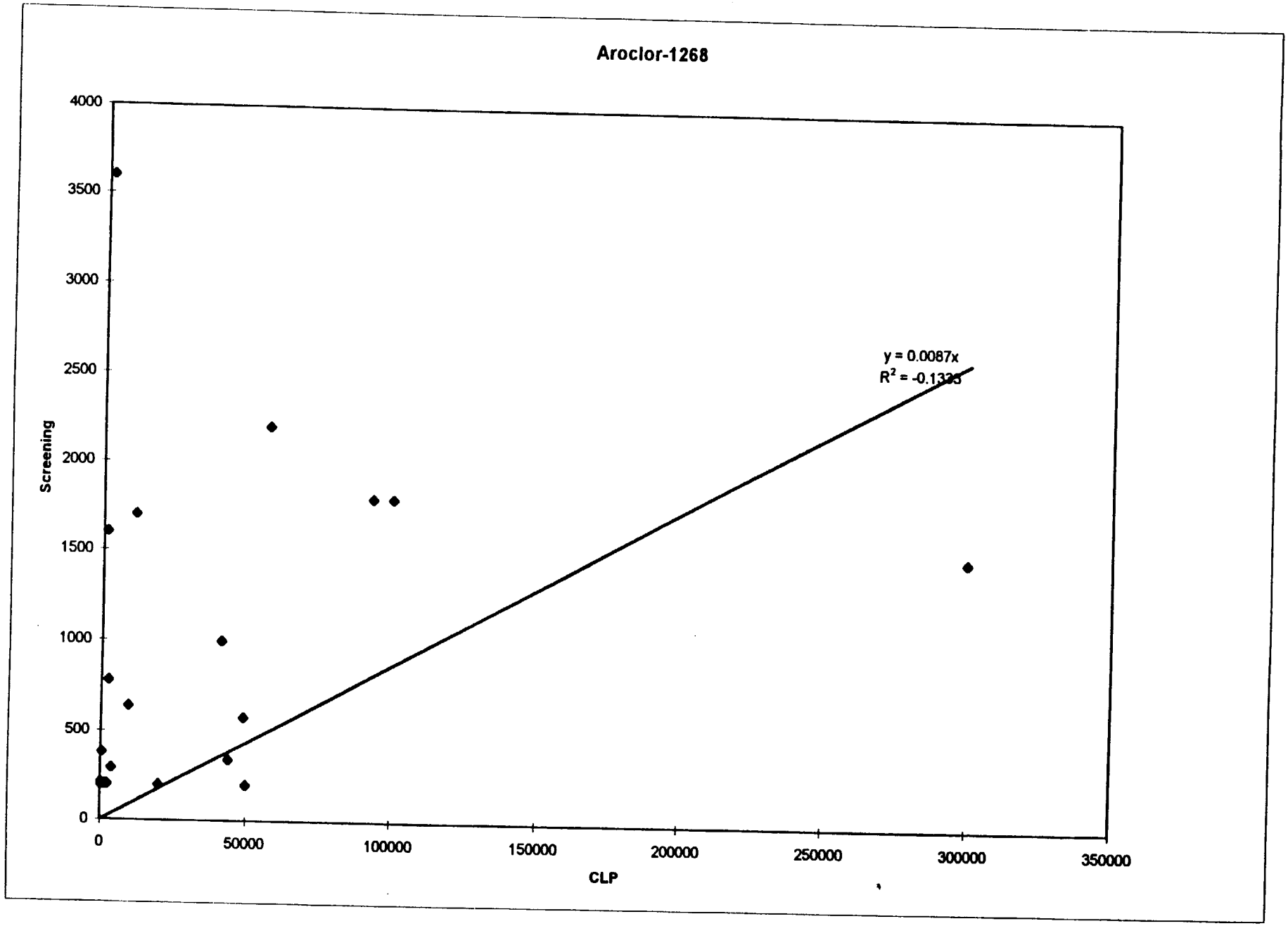

Copper - Correlation of CLP vs. Screening Data
y = 0.4328x
R² = 0.7573
Screening
CLP
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
20000
40000
60000
80000
100000
120000


Mid Range Copper Correlation
8000
7000
6000
5000
4000
3000
2000
1000
0
Screening
y = 0.8077x
R² = 0.5096
0
1000
2000
3000
4000
5000
6000
7000
CLP


Low Range Correlation
1600
1400
1200
1000
800
600
400
200
0
Screening
y = 0.9188x
R2 = 0.7278
0
200
400
600
800
1000
1200
1400
CLP


LEAD
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Screening
y = 0.3621x
R² = 0.7436
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
CLP


Aroclor-1262
14000
12000
10000
8000
6000
4000
2000
0
Screening
y = 0.0281x
R² = 0.1498
0
50000
100000
150000
200000
250000
CLP


Aroclor-1268
4000
3500
3000
2500
2000
1500
1000
500
0
Screening
y = 0.0087x
R^2 = -0.1335
0
50000
100000
150000
200000
250000
300000
350000
CLP

Copper Correlation Data

nsample	para	clp_res	clp_result	clp_qual	clp_units	scr_res	scr_result	scr_qual		clp_res	scr_res
SP-SO-MW110D-1820	COPPER	7	7		MG/KG	25	ND	U		7	25
MF-SO-MW101D-4850-D	COPPER	7.9	7.9		MG/KG	25	ND	U		7.9	25
MF-SO-MW101D-4850	COPPER	8.7	8.7		MG/KG	25	ND	U		8.7	25
SP-SO-MW112B-2628	COPPER	10.6	10.6		MG/KG	25	ND	U		10.6	25
MF-SO-MW104D-6062	COPPER	11.9	11.9		MG/KG	25	ND	U		11.9	25
MF-SO-MW101D-2830	COPPER	12.4	12.4		MG/KG	25	ND	U		12.4	25
MF-SO-SB5-1416	COPPER	13.8	13.8		MG/KG	8	8			13.8	8
MF-SO-MW104D-1618	COPPER	15.2	15.2		MG/KG	25	ND	U		15.2	25
MF-SO-MW102-7880	COPPER	17.2	17.2		MG/KG	25	ND	U		17.2	25
MF-SO-MW104D-3234	COPPER	17.2	17.2		MG/KG	25	ND	U		17.2	25
SP-SO-SB9-0608	COPPER	17.4	17.4	J	MG/KG	25	ND	U		17.4	25
MF-SO-MW102-2224	COPPER	18.5	18.5		MG/KG	25	ND	U		18.5	25
MF-SO-TP3-0405	COPPER	22.1	22.1		MG/KG	53	53	U		22.1	53
BC-SO-SB8A-0810	COPPER	22.9	22.9	J	MG/KG	25	ND	U		22.9	25
MF-SO-MW102-4244	COPPER	23.4	23.4		MG/KG	25	ND	U		23.4	25
MF-SO-MW104D-4648	COPPER	28.9	28.9		MG/KG	25	ND	U		28.9	25
SP-SO-SB1-0406B	COPPER	32.9	32.9	J	MG/KG	21	21			32.9	21
SP-SO-MW113B-0810	COPPER	33.8	33.8	J	MG/KG	25	ND	U		33.8	25
MF-SO-MW103-1416	COPPER	34.4	34.4		MG/KG	5900	5900			34.4	5900
MF-SO-SB1-0810	COPPER	35.8	35.8		MG/KG	26	26			35.8	26
BC-SO-SB9-0608	COPPER	37.4	37.4	J	MG/KG	25	ND	U		37.4	25
MF-SO-MW104D-0002	COPPER	40.3	40.3	J	MG/KG	25	ND	U		40.3	25
SP-SO-SB5-1214	COPPER	63.5	63.5		MG/KG	25	ND	U		63.5	25
SP-SO-SB9-0810	COPPER	73.3	73.3	J	MG/KG	250	250	J		73.3	250
SP-SO-SB7-0204	COPPER	73.5	73.5	J	MG/KG	25	ND	U		73.5	25
BC-SO-SB2-1214	COPPER	85.4	85.4	J	MG/KG	25	ND	U		85.4	25
SP-SO-MW111D-1012	COPPER	91.8	91.8	J	MG/KG	25	ND	U		91.8	25
SP-SO-MW110D-0406	COPPER	102	102		MG/KG	25	ND	U		102	25
MF-SO-MW101D-0608	COPPER	106	106	J	MG/KG	70	70			106	70
BC-SO-MW120-0406	COPPER	108	108		MG/KG	110	110	J		108	110
MF-SO-SB2-1416	COPPER	110	110		MG/KG	51	51			110	51
BC-SO-SB8A-1012	COPPER	129	129	J	MG/KG	25	ND	U		129	25
SP-SO-MW110D-1012	COPPER	160	160		MG/KG	110	110	J		160	110
SP-SO-MW111D-0810	COPPER	222	222	J	MG/KG	150	150	J		222	150
BC-SO-SB9-0204B	COPPER	234	234	J	MG/KG	170	170	J		234	170
MF-SO-SB8-0608	COPPER	287	287	J	MG/KG	410	410			287	410
MF-SO-SB3-0810	COPPER	352	352	J	MG/KG	95	95			352	95
SP-SO-SB6-0608A	COPPER	400	400		MG/KG	300	300			400	300
SP-SO-SB3-1416	COPPER	559	559	J	MG/KG	220	220			559	220
MF-SO-SB2-0608	COPPER	742	742		MG/KG	410	410			742	410
MF-SO-MW103-1618	COPPER	762	762		MG/KG	1400	1400			762	1400
SP-SO-MW113B-0406	COPPER	885	885	J	MG/KG	530	530			885	530
SP-SO-MW113B-0204B	COPPER	997	997	J	MG/KG	910	910			997	910
SP-SO-SB8-0002	COPPER	1230	1230	J	MG/KG	1300	1300			1230	1300
BC-SO-SB6-0810	COPPER	1450	1450		MG/KG	5500	5500			1450	5500
MF-SO-TP2-0506	COPPER	2270	2270		MG/KG	420	420			2270	420
MF-SO-SB7-1416	COPPER	2370	2370	J	MG/KG	3600	3600			2370	3600
SP-SO-MW112B-0810A	COPPER	2830	2830		MG/KG	1400	1400			2830	1400
BC-SO-SB5-0002B	COPPER	3770	3770		MG/KG	1000	1000			3770	1000
MF-SO-SB7-0406	COPPER	4000	4000	J	MG/KG	1300	1300			4000	1300
MF-SO-SB4-1214	COPPER	6260	6260		MG/KG	6700	6700			6260	6700
MF-SO-SB6-0204	COPPER	6390	6390		MG/KG	14000	14000			6390	14000
SP-SO-MW112B-0608	COPPER	7850	7850		MG/KG	2800	2800			7850	2800
MF-SO-MW102-0406	COPPER	11300	11300	J	MG/KG	4300	4300			11300	4300
SP-SO-SB4-0406	COPPER	12800	12800	J	MG/KG	12000	12000			12800	12000
MF-SO-SB4-0406	COPPER	13900	13900	J	MG/KG	150	150			13900	150
BC-SO-SB3-0204A	COPPER	15200	15200	J	MG/KG	7700	7700			15200	7700
BC-SO-SB1-0608	COPPER	17500	17500	J	MG/KG	5900	5900			17500	5900
SP-SO-SB2-0204B	COPPER	25200	25200		MG/KG	21000	21000			25200	21000
BC-SO-SB4-0204	COPPER	26300	26300		MG/KG	20000	20000			26300	20000
BC-SO-SB1-0406	COPPER	33200	33200	J	MG/KG	17000	17000			33200	17000
MF-SO-MW103-0810	COPPER	34600	34600		MG/KG	19000	19000			34600	19000
BC-SO-SB8-0204A	COPPER	49900	49900	J	MG/KG	30000	30000			49900	30000

BC-SO-SB1-0204B	COPPER	52300	52300	J	MG/KG	3900	3900			52300	3900
MF-SO-MW103-0608	COPPER	97900	97900		MG/KG	40000	40000			97900	40000

Lead Correlation Data

nsample	sample_no	location	para	clp_res	scr_res	clp_qual	scr_qual	units
SP-SO-MW112B-2628	MAES96	SP-SO-MW112B-2628	LEAD	2.1	0	J	U	MG/KG
MF-SO-MW104D-3234	MAES95	MF-SO-MW104D-3234	LEAD	2.2	0	J	U	MG/KG
MF-SO-MW101D-4850	MAES80	MF-SO-MW101D-4850	LEAD	2.3	0	UJ	U	MG/KG
MF-SO-MW101D-4850-D	MAES81	MF-SO-MW101D-4850	LEAD	2.3	0	UJ	U	MG/KG
MF-SO-MW104D-6062	MAET04	MF-SO-MW104D-6062	LEAD	2.5	30	J	J	MG/KG
SP-SO-MW110D-1820	MAET10	SP-SO-MW110D-1820	LEAD	3	0	J	U	MG/KG
MF-SO-MW101D-2830	MAES78	MF-SO-MW101D-2830	LEAD	3.1	0	UJ	U	MG/KG
MF-SO-SB5-1416	MAEG35	MF-SO-SB5-1416	LEAD	3.3	9		U	MG/KG
MF-SO-MW102-4244	MAES94	MF-SO-MW102-4244	LEAD	3.8	0	J	U	MG/KG
MF-SO-MW104D-4648	MAET03	MF-SO-MW104D-4648	LEAD	5.6	0	J	U	MG/KG
MF-SO-SB1-0810	MAEG32	MF-SO-SB1-0810	LEAD	6	10		U	MG/KG
MF-SO-MW102-7880	MAET02	MF-SO-MW102-7880	LEAD	6.5	0	J	U	MG/KG
MF-SO-MW102-2224	MAES79	MF-SO-MW102-2224	LEAD	6.7	0	J	U	MG/KG
MF-SO-MW104D-1618	MAES91	MF-SO-MW104D-1618	LEAD	7.3	0	J	U	MG/KG
BC-SO-SB8A-0810	MAET39	BC-SO-SB8A-0810	LEAD	12.3	0	U	U	MG/KG
MF-SO-MW103-1416	MAES98	MF-SO-MW103-1416	LEAD	18.2	2900	J		MG/KG
BC-SO-SB9-0608	MAET35	BC-SO-SB9-0608	LEAD	20.8	39		J	MG/KG
SP-SO-SB1-0406B	MAES73	SP-SO-SB1-0406B	LEAD	26.6	16	J		MG/KG
MF-SO-MW104D-0002	MAES87	MF-SO-MW104D-0002	LEAD	26.8	0	J	U	MG/KG
SP-SO-SB9-0608	MAET37	SP-SO-SB9-0608	LEAD	32	0		U	MG/KG
SP-SO-MW113B-0810	MAET25	SP-SO-MW113B-0810	LEAD	40.1	0		U	MG/KG
SP-SO-SB5-1214	MAES83	SP-SO-SB5-1214	LEAD	52.7	0	J	U	MG/KG
BC-SO-MW120-0406	MAES77	BC-SO-MW120-0406	LEAD	55.3	61	J	J	MG/KG
MF-SO-TP3-0405	MAEH50	MF-SO-TP3-0405	LEAD	59.8	173			MG/KG
MF-SO-SB2-1416	MAEG34	MF-SO-SB2-1416	LEAD	72.5	31			MG/KG
BC-SO-SB2-1214	MAEF93	BC-SO-SB2-1214	LEAD	75.9	0	J	U	MG/KG
SP-SO-SB7-0204	MAET06	SP-SO-SB7-0204	LEAD	89.9	53			MG/KG
BC-SO-SB8A-1012	MAET40	BC-SO-SB8A-1012	LEAD	94.1	49		J	MG/KG
SP-SO-SB9-0810	MAET38	SP-SO-SB9-0810	LEAD	101	280			MG/KG
SP-SO-MW111D-0810-D	MAET22	SP-SO-MW111D-0810	LEAD	122	140			MG/KG
MF-SO-MW101D-0608	MAEH58	MF-SO-MW101D-0608	LEAD	130	71	J		MG/KG
BC-SO-SB9-0204B	MAET34	BC-SO-SB9-0204B	LEAD	137	140			MG/KG
SP-SO-MW113B-0204B	MAET24	SP-SO-MW113B-0204B	LEAD	157	120			MG/KG
SP-SO-MW113B-0406	MAET29	SP-SO-MW113B-0406	LEAD	182	170			MG/KG
SP-SO-MW111D-1012	MAET23	SP-SO-MW111D-1012	LEAD	183	130			MG/KG
MF-SO-SB3-0810	MAEH53	MF-SO-SB3-0810	LEAD	189	18	J		MG/KG
SP-SO-MW113B-0608	MAET26	SP-SO-MW113B-0608	LEAD	215	210			MG/KG
MF-SO-SB3-0810-D	MAEH54	MF-SO-SB3-0810	LEAD	227	59	J		MG/KG
SP-SO-SB6-0608A	MAES84	SP-SO-SB6-0608A	LEAD	273	270	J		MG/KG
MF-SO-MW103-1618	MAET00	MF-SO-MW103-1618	LEAD	275	500	J		MG/KG
SP-SO-MW110D-0406	MAET08	SP-SO-MW110D-0406	LEAD	305	160	J		MG/KG
MF-SO-SB8-0608	MAET18	MF-SO-SB8-0608	LEAD	310	530			MG/KG
SP-SO-MW111D-0810	MAET21	SP-SO-MW111D-0810	LEAD	354	130			MG/KG
SP-SO-MW110D-1012	MAET13	SP-SO-MW110D-1012	LEAD	363	160	J		MG/KG
SP-SO-SB3-1416	MAES85	SP-SO-SB3-1416	LEAD	459	180	J		MG/KG
MF-SO-SB2-0608	MAEG33	MF-SO-SB2-0608	LEAD	678	290			MG/KG
BC-SO-SB6-0810	MAES76	BC-SO-SB6-0810	LEAD	946	3200	J		MG/KG
MF-SO-TP2-0506	MAEH49	MF-SO-TP2-0506	LEAD	1290	270			MG/KG
SP-SO-SB8-0002	MAET33	SP-SO-SB6-0002	LEAD	1480	1100			MG/KG
MF-SO-SB7-0406	MAET17	MF-SO-SB7-0406	LEAD	1690	670			MG/KG
SP-SO-MW112B-0810A	MAES93	SP-SO-MW112B-0810A	LEAD	1870	630	J		MG/KG
BC-SO-SB5-0002B	MAES75	BC-SO-SB5-0002B	LEAD	2460	660	J		MG/KG
MF-SO-SB4-1214	MAEH55	MF-SO-SB4-1214	LEAD	3220	200			MG/KG
MF-SO-SB7-1416	MAET16	MF-SO-SB7-1416	LEAD	3980	3000			MG/KG

SP-SO-MW112B-0608	MAES92	SP-SO-MW112B-0608	LEAD	5390	1200	J		MG/KG
MF-SO-MW102-0406	MAES71	MF-SO-MW102-0406	LEAD	7400	2300	J		MG/KG
MF-SO-MW102-0406-D	MAES72	MF-SO-MW102-0406	LEAD	7450	2700	J		MG/KG
MF-SO-SB6-0204	MAEH48	MF-SO-SB6-0204	LEAD	9600	6600			MG/KG
SP-SO-SB4-0406	MAES86	SP-SO-SB4-0406	LEAD	11500	8200	J		MG/KG
BC-SO-SB1-0608	MAES89	BC-SO-SB1-0608	LEAD	11500	4800	J		MG/KG
MF-SO-SB4-0406	MAES88	MF-SO-SB4-0406	LEAD	11600	310	J		MG/KG
BC-SO-SB3-0204A	MAEH57	BC-SO-SB3-0204A	LEAD	12000	5800	J		MG/KG
SP-SO-SB2-0204B	MAES82	SP-SO-SB2-0204B	LEAD	13600	9100	J		MG/KG
MF-SO-MW103-0810	MAES99	MF-SO-MW103-0810	LEAD	14900	6300	J		MG/KG
MF-SO-MW103-0608	MAET01	MF-SO-MW103-0608	LEAD	25600	7200	J		MG/KG
BC-SO-SB8-0204A	MAET27	BC-SO-SB8-0204A	LEAD	32400	18000			MG/KG
BC-SO-SB4-0204	MAES74	BC-SO-SB4-0204	LEAD	32900	11000	J		MG/KG
BC-SO-SB1-0204B	MAEF91	BC-SO-SB1-0204B	LEAD	32900	2100	J		MG/KG
BC-SO-SB1-0406	MAEF92	BC-SO-SB1-0406	LEAD	38700	16000	J		MG/KG

Aroclor 1262 Correlation Data

nsample	sample_no	location	para	clp_res	scr_res	qual	units	scr_qual
MF-SO-MW104D-6062	SAA687	MF-SO-MW104D-6062	AROCLOR-1262	18.5	100	U	UG/KG	U
MF-SO-MW102-2224	SAA663	MF-SO-MW102-2224	AROCLOR-1262	18.5	100	U	UG/KG	U
MF-SO-MW102-7880	SAA685	MF-SO-MW102-7880	AROCLOR-1262	19	100	U	UG/KG	U
MF-SO-SB5-1416	SA4046	MF-SO-SB5-1416	AROCLOR-1262	19	100	U	UG/KG	U
SP-SO-MW110D-1820	SAA694	SP-SO-MW110D-1820	AROCLOR-1262	19.5	100	UJ	UG/KG	U
MF-SO-SB1-0810	SA4043	MF-SO-SB1-0810	AROCLOR-1262	20	100	U	UG/KG	U
MF-SO-MW104D-0002	SAA671	MF-SO-MW104D-0002	AROCLOR-1262	20	100	U	UG/KG	U
MF-SO-MW104D-3234	SAA678	MF-SO-MW104D-3234	AROCLOR-1262	20	100	U	UG/KG	U
MF-SO-MW101D-4850	SAA664	MF-SO-MW101D-4850	AROCLOR-1262	20	100	U	UG/KG	U
MF-SO-MW101D-4850-D	SAA665	MF-SO-MW101D-4850	AROCLOR-1262	20	100	U	UG/KG	U
MF-SO-MW101D-2830	SAA662	MF-SO-MW101D-2830	AROCLOR-1262	20.5	100	U	UG/KG	U
SP-SO-MW112B-2628	SAA679	SP-SO-MW112B-2628	AROCLOR-1262	20.5	100	U	UG/KG	U
MF-SO-MW102-4244	SAA677	MF-SO-MW102-4244	AROCLOR-1262	22.5	100	U	UG/KG	U
MF-SO-MW104D-4648	SAA686	MF-SO-MW104D-4648	AROCLOR-1262	23.5	100	U	UG/KG	U
SP-SO-SB1-0406B	SAA651	SP-SO-SB1-0406B	AROCLOR-1262	26	100	J	UG/KG	U
BC-SO-SB9-0608	SA9041	BC-SO-SB9-0608	AROCLOR-1262	29	100	J	UG/KG	U
MF-SO-MW104D-1618	SAA674	MF-SO-MW104D-1618	AROCLOR-1262	31.5	100	U	UG/KG	U
MF-SO-MW103-1416	SAA681	MF-SO-MW103-1416	AROCLOR-1262	38.5	100	U	UG/KG	U
SP-SO-SB5-1214	SAA667	SP-SO-SB5-1214	AROCLOR-1262	51	100	J	UG/KG	U
SP-SO-MW113B-0810	SA2742	SP-SO-MW113B-0810	AROCLOR-1262	58	100	J	UG/KG	U
BC-SO-SB8A-0810	SA2773	BC-SO-SB8A-0810	AROCLOR-1262	69	100	J	UG/KG	U
SP-SO-MW113B-0204B	SA2741	SP-SO-MW113B-0204B	AROCLOR-1262	72	100	J	UG/KG	U
MF-SO-SB2-1416	SA4045	MF-SO-SB2-1416	AROCLOR-1262	76	100	J	UG/KG	U
MF-SO-TP3-0405	SAA640	MF-SO-TP3-0405	AROCLOR-1262	79	100		UG/KG	U
SP-SO-SB7-0204	SA2748	SP-SO-SB7-0204	AROCLOR-1262	90	100	J	UG/KG	U
SP-SO-MW113B-0406	SA2746	SP-SO-MW113B-0406	AROCLOR-1262	99	100	J	UG/KG	U
SP-SO-MW110D-0002	SAA696	SP-SO-MW110D-0002	AROCLOR-1262	140	100	J	UG/KG	U
BC-SO-SB9-0204B	SAA656	BC-SO-SB9-0204B	AROCLOR-1262	180	100	J	UG/KG	U
SP-SO-SB9-0810	SA9043	SP-SO-SB9-0810	AROCLOR-1262	230	360	J	UG/KG	
MF-SO-SB3-0810	SAA652	MF-SO-SB3-0810	AROCLOR-1262	230	100	J	UG/KG	U
SP-SO-MW110D-0406	SAA692	SP-SO-MW110D-0406	AROCLOR-1262	240	100	J	UG/KG	U
SP-SO-SB6-0608A	SAA668	SP-SO-SB6-0608A	AROCLOR-1262	260	100	J	UG/KG	U
MF-SO-SB4-1214	SAA654	MF-SO-SB4-1214	AROCLOR-1262	280	100		UG/KG	U
BC-SO-SB2-1214	SAA645	BC-SO-SB2-1214	AROCLOR-1262	280	220		UG/KG	
MF-SO-SB3-0810-D	SAA653	MF-SO-SB3-0810	AROCLOR-1262	320	100	J	UG/KG	U
BC-SO-SB8A-1012	SA2774	BC-SO-SB8A-1012	AROCLOR-1262	330	100	J	UG/KG	U
SP-SO-MW111D-0810-D	SA2739	SP-SO-MW111D-0810	AROCLOR-1262	340	100	J	UG/KG	U
MF-SO-SB8-0608	SA2734	MF-SO-SB8-0608	AROCLOR-1262	340	100	J	UG/KG	U
BC-SO-MW120-0406	SAA661	BC-SO-MW120-0406	AROCLOR-1262	380	100		UG/KG	U
SP-SO-MW111D-0810	SA2738	SP-SO-MW111D-0810	AROCLOR-1262	500	100	J	UG/KG	U
MF-SO-MW101D-0608	SAA648	MF-SO-MW101D-0608	AROCLOR-1262	540	100		UG/KG	U
MF-SO-TP2-0506	SA4048	MF-SO-TP2-0506	AROCLOR-1262	550	100		UG/KG	U
SP-SO-SB9-0608	SA9042	SP-SO-SB9-0608	AROCLOR-1262	580	100	J	UG/KG	U
MF-SO-SB7-0406	SA2733	MF-SO-SB7-0406	AROCLOR-1262	650	100	J	UG/KG	U
SP-SO-SB4-0406	SAA670	SP-SO-SB4-0406	AROCLOR-1262	1100	9100		UG/KG	
MF-SO-SB2-0608	SA4044	MF-SO-SB2-0608	AROCLOR-1262	1500	2800	J	UG/KG	
BC-SO-SB5-0002B	SAA659	BC-SO-SB5-0002B	AROCLOR-1262	2100	410	J	UG/KG	
MF-SO-MW102-0406-D	SAA650	MF-SO-MW102-0406	AROCLOR-1262	2600	200		UG/KG	
SP-SO-SB3-1416	SAA669	SP-SO-SB3-1416	AROCLOR-1262	2800	100	J	UG/KG	U
MF-SO-MW102-0406	SAA649	MF-SO-MW102-0406	AROCLOR-1262	2900	100		UG/KG	U
SP-SO-MW112B-0608	SAA675	SP-SO-MW112B-0608	AROCLOR-1262	3600	1700	J	UG/KG	
SP-SO-SB8-0002	SAA655	SP-SO-SB8-0002	AROCLOR-1262	7700	1800	J	UG/KG	
BC-SO-SB1-0204B	SAA643	BC-SO-SB1-0204B	AROCLOR-1262	17000	240		UG/KG	
MF-SO-MW103-0810	SAA682	MF-SO-MW103-0810	AROCLOR-1262	21000	1900		UG/KG	
BC-SO-SB6-0810	SAA660	BC-SO-SB6-0810	AROCLOR-1262	23000	400		UG/KG	
MF-SO-SB7-1416	SAA690	MF-SO-SB7-1416	AROCLOR-1262	36000	100	J *	UG/KG	U

MF-SO-SB6-0204	SA4047	MF-SO-SB6-0204	AROCLOR-1262	48000	780		UG/KG	
BC-SO-SB3-0204A	SAA647	BC-SO-SB3-0204A	AROCLOR-1262	70000	1100		UG/KG	
BC-SO-SB4-0204	SAA658	BC-SO-SB4-0204	AROCLOR-1262	79000	2300		UG/KG	
BC-SO-SB1-0406	SAA644	BC-SO-SB1-0406	AROCLOR-1262	81000	2100		UG/KG	
SP-SO-SB2-0204B	SAA666	SP-SO-SB2-0204B	AROCLOR-1262	97000	12000		UG/KG	
BC-SO-SB8-0204A	SA2744	BC-SO-SB8-0204A	AROCLOR-1262	230000	2900	J	UG/KG	

Aroclor 1268 Correlation Data

nsample	sample_no	location	para	clp_res	scr_res	clp_qual	scr_qual	units
MF-SO-MW102-2224	SAA663	MF-SO-MW102-2224	AROCLOR-1268	3	200	J	U	UG/KG
MF-SO-MW102-7880	SAA685	MF-SO-MW102-7880	AROCLOR-1268	3.5	200	J	U	UG/KG
MF-SO-TP3-0405	SAA640	MF-SO-TP3-0405	AROCLOR-1268	19	200	J	U	UG/KG
SP-SO-SB1-0406B	SAA651	SP-SO-SB1-0406B	AROCLOR-1268	32	200	J	U	UG/KG
BC-SO-SB9-0608	SA9041	BC-SO-SB9-0608	AROCLOR-1268	33	200	J	U	UG/KG
MF-SO-MW103-1416	SAA681	MF-SO-MW103-1416	AROCLOR-1268	34	200	J	U	UG/KG
MF-SO-MW104D-6062	SAA687	MF-SO-MW104D-6062	AROCLOR-1268	37	200	U	U	UG/KG
MF-SO-SB5-1416	SA4046	MF-SO-SB5-1416	AROCLOR-1268	38	200	U	U	UG/KG
SP-SO-MW110D-1820	SAA694	SP-SO-MW110D-1820	AROCLOR-1268	39	200	UJ	U	UG/KG
MF-SO-SB1-0810	SA4043	MF-SO-SB1-0810	AROCLOR-1268	40	200	U	U	UG/KG
MF-SO-MW104D-0002	SAA671	MF-SO-MW104D-0002	AROCLOR-1268	40	200	U	U	UG/KG
MF-SO-MW104D-3234	SAA678	MF-SO-MW104D-3234	AROCLOR-1268	40	200	U	U	UG/KG
MF-SO-MW101D-4850	SAA664	MF-SO-MW101D-4850	AROCLOR-1268	40	200	U	U	UG/KG
MF-SO-MW101D-4850-D	SAA665	MF-SO-MW101D-4850	AROCLOR-1268	40	200	U	U	UG/KG
MF-SO-MW101D-2830	SAA662	MF-SO-MW101D-2830	AROCLOR-1268	41	200	U	U	UG/KG
SP-SO-MW112B-2628	SAA679	SP-SO-MW112B-2628	AROCLOR-1268	41	200	U	U	UG/KG
MF-SO-MW102-4244	SAA677	MF-SO-MW102-4244	AROCLOR-1268	45	200	U	U	UG/KG
MF-SO-MW104D-4648	SAA686	MF-SO-MW104D-4648	AROCLOR-1268	47	200	U	U	UG/KG
SP-SO-SB6-0608A	SAA668	SP-SO-SB6-0608A	AROCLOR-1268	51	200	J	U	UG/KG
MF-SO-MW104D-1618	SAA674	MF-SO-MW104D-1618	AROCLOR-1268	63	200	U	U	UG/KG
SP-SO-MW113B-0204B	SA2741	SP-SO-MW113B-0204B	AROCLOR-1268	65	200	J	U	UG/KG
SP-SO-MW113B-0810	SA2742	SP-SO-MW113B-0810	AROCLOR-1268	78	200	J	U	UG/KG
BC-SO-SB8A-0810	SA2773	BC-SO-SB8A-0810	AROCLOR-1268	82	200	J	U	UG/KG
SP-SO-SB5-1214	SAA667	SP-SO-SB5-1214	AROCLOR-1268	84	200		U	UG/KG
MF-SO-SB2-1416	SA4045	MF-SO-SB2-1416	AROCLOR-1268	92	200		U	UG/KG
BC-SO-MW120-0406	SAA661	BC-SO-MW120-0406	AROCLOR-1268	120	200	J	U	UG/KG
SP-SO-SB7-0204	SA2748	SP-SO-SB7-0204	AROCLOR-1268	130	200	J	U	UG/KG
BC-SO-SB9-0204B	SAA656	BC-SO-SB9-0204B	AROCLOR-1268	130	200	J	U	UG/KG
SP-SO-MW113B-0406	SA2746	SP-SO-MW113B-0406	AROCLOR-1268	150	200	J	U	UG/KG
SP-SO-MW110D-0002	SAA696	SP-SO-MW110D-0002	AROCLOR-1268	200	210	J		UG/KG
MF-SO-SB3-0810	SAA652	MF-SO-SB3-0810	AROCLOR-1268	250	200	J	U	UG/KG
SP-SO-SB9-0608	SA9042	SP-SO-SB9-0608	AROCLOR-1268	260	200	J	U	UG/KG
MF-SO-SB4-1214	SAA654	MF-SO-SB4-1214	AROCLOR-1268	260	200		U	UG/KG
SP-SO-MW110D-0406	SAA692	SP-SO-MW110D-0406	AROCLOR-1268	270	200	J	U	UG/KG
MF-SO-SB7-0406	SA2733	MF-SO-SB7-0406	AROCLOR-1268	340	200	J	U	UG/KG
BC-SO-SB2-1214	SAA645	BC-SO-SB2-1214	AROCLOR-1268	340	200		U	UG/KG
MF-SO-SB3-0810-D	SAA653	MF-SO-SB3-0810	AROCLOR-1268	350	200	J	U	UG/KG
SP-SO-SB9-0810	SA9043	SP-SO-SB9-0810	AROCLOR-1268	400	380	J		UG/KG
SP-SO-MW111D-0810	SA2738	SP-SO-MW111D-0810	AROCLOR-1268	420	200	J	U	UG/KG
BC-SO-SB8A-1012	SA2774	BC-SO-SB8A-1012	AROCLOR-1268	490	200	J		UG/KG
MF-SO-SB8-0608	SA2734	MF-SO-SB8-0608	AROCLOR-1268	490	200	J	U	UG/KG
MF-SO-TP2-0506	SA4048	MF-SO-TP2-0506	AROCLOR-1268	500	200		U	UG/KG
MF-SO-MW101D-0608	SAA648	MF-SO-MW101D-0608	AROCLOR-1268	620	200		U	UG/KG
SP-SO-MW111D-0810-D	SA2739	SP-SO-MW111D-0810	AROCLOR-1268	760	200	J	U	UG/KG
MF-SO-SB2-0608	SA4044	MF-SO-SB2-0608	AROCLOR-1268	1200	1600			UG/KG
SP-SO-SB4-0406	SAA670	SP-SO-SB4-0406	AROCLOR-1268	1600	3600			UG/KG
MF-SO-MW102-0406-D	SAA650	MF-SO-MW102-0406	AROCLOR-1268	1600	200		U	UG/KG
MF-SO-MW102-0406	SAA649	MF-SO-MW102-0406	AROCLOR-1268	1800	200		U	UG/KG
SP-SO-SB3-1416	SAA669	SP-SO-SB3-1416	AROCLOR-1268	2400	200		U	UG/KG
SP-SO-MW112B-0608	SAA675	SP-SO-MW112B-0608	AROCLOR-1268	2400	780			UG/KG
BC-SO-SB5-0002B	SAA659	BC-SO-SB5-0002B	AROCLOR-1268	3800	290			UG/KG
MF-SO-MW103-0810	SAA682	MF-SO-MW103-0810	AROCLOR-1268	9300	640			UG/KG
SP-SO-SB8-0002	SAA655	SP-SO-SB8-0002	AROCLOR-1268	11000	1700	J		UG/KG
BC-SO-SB1-0204B	SAA643	BC-SO-SB1-0204B	AROCLOR-1268	20000	200		U	UG/KG
BC-SO-SB6-0810	SAA660	BC-SO-SB6-0810	AROCLOR-1268	41000	1000			UG/KG
BC-SO-SB3-0204A	SAA647	BC-SO-SB3-0204A	AROCLOR-1268	44000	340			UG/KG
MF-SO-SB6-0204	SA4047	MF-SO-SB6-0204	AROCLOR-1268	49000	580			UG/KG
MF-SO-SB7-1416	SAA690	MF-SO-SB7-1416	AROCLOR-1268	50000	200	J *	U	UG/KG

SP-SO-SB2-0204B	SAA666	SP-SO-SB2-0204B	AROCLOR-1268	57000	2200			UG/KG
BC-SO-SB4-0204	SAA658	BC-SO-SB4-0204	AROCLOR-1268	93000	1800			UG/KG
BC-SO-SB1-0406	SAA644	BC-SO-SB1-0406	AROCLOR-1268	100000	1800			UG/KG
BC-SO-SB8-0204A	SA2744	BC-SO-SB8-0204A	AROCLOR-1268	300000	1500	J		UG/KG

Lead Linear Regression Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.864407719
R Square	0.747200705
Adjusted R Square	0.743427582
Standard Error	4504.308087
Observations	69

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4017837739	4017837739	198.032385	1.10015E-21
Residual	67	1359349020	20288791.34		
Total	68	5377186759			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 50.0%*	*Upper 50.0%*
Intercept	557.588161	600.8487517	0.928000865	0.356738283	-641.7112978	1756.88762	150.1110006	965.0653215
X Variable 1	2.124784321	0.150989499	14.07239798	1.10015E-21	1.823407937	2.426160706	2.022387883	2.22718076

Copper Linear Regression Output (Low-range Data)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.852977736
R Square	0.727571018
Adjusted R Square	0.677571018
Standard Error	212.3416465
Observations	21

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2408365.741	2408365.741	53.41362827	6.24751E-07
Residual	20	901779.4968	45088.97484		
Total	21	3310145.238			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.918791541	0.092076695	9.978546048	3.28009E-09	0.72672301	1.110860072	0.72672301	1.110860072

Copper Linear Regression Output (Mid-range Data)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.713327397
R Square	0.508835975
Adjusted R Square	0.471798938
Standard Error	1153.781792
Observations	28

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	37235945.5	37235945.5	27.9714528	1.57064E-05
Residual	27	35942735.46	1331212.425		
Total	28	73178680.96			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.807749021	0.118003473	6.845129239	2.3605E-07	0.565626057	1.049871986	0.565626057	1.049871986

Copper Linear Regression Output (All Data)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.870217975
R Square	0.757279324
Adjusted R Square	0.741654324
Standard Error	3786.611241
Observations	65

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2863061909	2863061909	199.6775776	3.35283E-21
Residual	64	917659180.1	14338424.69		
Total	65	3780721089			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.432816293	0.027008707	16.02506504	4.38521E-24	0.378860246	0.48677234	0.378860246	0.48677234

Aroclor 1262 Linear Regression Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.386977446
R Square	0.149751544
Adjusted R Square	0.133358101
Standard Error	1802.075377
Observations	62

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	34890018.25	34890018.25	10.74373509	0.001742955
Residual	61	198096015.6	3247475.666		
Total	62	232986033.9			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
X Variable 1	0.028137317	0.006181947	4.551529905	2.5955E-05	0.015775746	0.040498888	0.015775746	0.040498888

Aroclor 1268 Linear Regression Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.429221558
R Square	0.184231146
Adjusted R Square	0.170634998
Standard Error	38817.30776
Observations	62

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	20417285635	20417285635	13.55024609	0.000499429
Residual	60	90407002918	1506783382		
Total	61	1.10824E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 50.0%*	*Upper 50.0%*
Intercept	-204.9824707	6072.973874	-0.033753228	0.973185972	-12352.73494	11942.77	-4326.106874	3916.141933
X Variable 1	29.09476683	7.90389732	3.681065891	0.000499429	13.28462337	44.90491029	23.73117647	34.45835719

Copper t-Test Output

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	6700.495385	3549.830769
Variance	261525929.3	59073767.02
Observations	65	65
Pooled Variance	160299848.2	
Hypothesized Mean Difference	0	
df	128	
t Stat	1.418656658	
P(T<=t) one-tail	0.079214719	
t Critical one-tail	1.656844688	
P(T<=t) two-tail	0.158429439	
t Critical two-tail	1.978669388	

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	4199.56087	1714.043478
Variance	79076275.86	13087412.01
Observations	69	69
Pooled Variance	46081843.94	
Hypothesized Mean Difference	0	
df	136	
t Stat	2.150608854	
P(T<=t) one-tail	0.016637564	
t Critical one-tail	1.656135282	
P(T<=t) two-tail	0.033275128	
t Critical two-tail	1.977559805	

Appendix F.2

Summary of RSRs Developed by B&RE for New London (1998)

Brown & Root Environmental

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[illegible] Andersen Drive
[illegible]sburgh, PA 15220-2745

(412) 921-[illegible]
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C-49-12-7-188

December 23, 1997

Brown & Root Environmental Project Number 7237

Mr. Mark Lewis
Connecticut Department of Environmental Protection
Water Management Bureau
Permitting, Enforcement, and Remediation Division
Federal Remediation Program
79 Elm Street
Hartford, Connecticut 06106-5127

Reference: CLEAN Contract No. N62472-90-D-1298
Contract Task Order No. 0260

Subject: Calculated CTDEP Remediation Standards
Lower Subase Remedial Investigation
Naval Submarine Base - New London, Groton, Connecticut

Dear Mr. Lewis:

In preparation of the Lower Subase Remedial Investigation (RI) Report, Brown & Root (B&R) Environmental has calculated Remediation Standards following the State of Connecticut Remediation Standard Regulations of January 1996. Standards were developed for all chemicals that were analyzed for during the RI sampling and analysis program that did not have previously established CTDEP standards. The intent of this memo is to identify the sources of the standards to be used in the RI Report and to identify those values which have been developed by B&R Environmental using the State guidance.

Background information and the calculated Remediation Standards are provided in Table 1 and Table 2, respectively, which are enclosed. Table 1 summarizes the basis for the chemical-specific remediation standards (i.e., promulgated, calculated, or calculated using a surrogate) to be included in the RI. The calculated soil Direct Exposure and Pollutant Mobility standards, as well as the Groundwater Standard, are provided in Table 2.

It should be noted that pollutant mobility and groundwater standards for GA classified groundwater are provided in Table 2 for completeness. The groundwater at the Lower Subase is classified as GB, therefore standards applicable to GB classified groundwater will be emphasized in the Lower Subase RI Report.

B&R Environmental intends on using these criteria, as well as Region III RBCs, as part of the human health risk assessment for the Lower Subase RI to screen for chemicals of potential concern. Therefore, B&R Environmental, on the behalf of the United States Navy, requests that the CTDEP review and approve the standards in Table 2. It is hoped that prior approval of the criteria will alleviate unnecessary revisions to the RI Report in the future and expedite any additional risk-related work required by the State (i.e., application for use of alternative criteria).

Due to the current time constraints for preparing the Lower Subase RI, it is requested that the CTDEP complete their review by no later than January 16, 1997. If you have any questions regarding the information provided in the tables or the schedule for the review please contact Mr. Mark Evans at (610) 595-0567 (ext. 162) or me at (412) 921-8244.

Very truly yours,

Corey A. Rich, P.E.
Project Manager

Enclosure(s)

c: Mr. Mark Evans, NORTHDIV
Mr. Richard Conant, NSB-NLON Environmental
Ms. Karen Smecker, B&R Environmental
File: CTO 0260

TABLE 1

SOURCE OF CONNECTICUT REMEDIATION STANDARDS
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
Acenaphthene	83329	SVOC		X	
Acenaphthylene	208968	SVOC	X		
Anthracene	120127	SVOC	X		
Acetone	67641	VOC	X		
Aldrin	309002	PEST		X	
Aluminum	7429905	INORG	[4]	[4]	[4]
Antimony	7440360	INORG	X		
Arsenic	7440382	INORG	X		
Barium	7440393	INORG	X		
Benzene	71432	VOC	X		
Benz(a)anthracene	56553	SVOC	X		
Benzo(b)fluoranthene	205992	SVOC	X		
Benzo(k)fluoranthene	207089	SVOC	X		
Benzo(g,h,i)perylene	191242	SVOC			X (naphthalene)
Benzo(a)pyrene	50328	SVOC	X		
Beryllium	7440417	INORG	X		
BCH (alpha-)	319846	PEST		X	
BCH (beta-)	319857	PEST		X	
BCH (delta-)	319868	PEST			X (alpha-BHC)
BCH (gamma-; Lindane)	58899	PEST	X		
Bis(2-chloroethoxy)methane	111911	SVOC	[5]	[5]	[5]
Bis(2-chloroethyl)ether	111444	SVOC	X		
Bis(2-ethylhexyl)phthalate	117817	SVOC	X		
Bromochloromethane	74975	VOC			X (chloromethane)
Bromodichloromethane	75274	VOC		X	
Bromoform	75252	VOC	X		
Bromomethane	74839	VOC		X	
4-Bromophenyl-phenylether	101553	SVOC		X	
2-Butanone	78933	VOC	X		
Butylbenzylphthalate	85687	SVOC	X		
Cadmium	7440439	INORG	X		
Calcium	7440702	INORG	[6]	[6]	[6]
Carbazole	86748	SVOC		X	
Carbon disulfide	75150	VOC		X	
Carbon tetrachloride	56235	VOC	X		
Chlordane (alpha-)	57749	PEST	X[7]		
Chlordane (gamma-)	57749	PEST	X[7]		
4-Chloroaniline	106478	SVOC		X	
Chlorobenzene	108907	VOC	X		
Chlorodibromomethane	124481	VOC	X		
Chloroethane	75003	VOC		X	
Chloroform	67663	VOC	X		
Chloromethane	74873	VOC		X	

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Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
4-Chloro-3-methylphenol	59507	SVOC			X (3-methylphenol)
2-Chloronaphthalene	91587	SVOC		X	
2-Chlorophenol	95578	SVOC	X		
4-Chlorophenyl-phenylether	7005723	SVOC			X (4-Bromophenyl-phenylether)
Chromium (total)		INORG	X[8]		
Chrysene	218019	SVOC		X	
Cobalt	7440484	INORG		X	
Copper	7440508	INORG	[4]	[4]	[4]
4,4'-DDD	72548	PEST		X	
4,4'-DDE	72559	PEST		X	
4,4'-DDT	50293	PEST		X	
Dibenzofuran	132649	SVOC		X	
Dibenz(a,h)anthracene	53703	SVOC		X	
1,2-Dibromo-3-chloropropane	96128	VOC		X	
1,2-Dibromoethane	106934	VOC		X	
1,2-Dichlorobenzene	95501	VOC/SVOC	X		
1,3-Dichlorobenzene	541731	VOC/SVOC	X		
1,4-Dichlorobenzene	106467	VOC/SVOC	X		
3,3'-Dichlorobenzidine	91941	SVOC		X	
1,1-Dichloroethane	75343	VOC	X		
1,2-Dichloroethane	107062	VOC	X		
1,1-Dichloroethene	75354	VOC	X		
1,2-Dichloroethene (cis-)	156592	VOC	X		
1,2-Dichloroethene (trans-)	156605	VOC	X		
1,2-Dichloroethene (total)	156605	VOC		X	
2,4-Dichlorophenol	120832	SVOC	X		
1,2-Dichloropropane	78875	VOC	X		
1,3-Dichloropropene (cis-)	542756	VOC	X		
1,3-Dichloropropene (trans-)	542756	VOC	X		
Dieldrin	60571	PEST	X		
Diethyl phthalate	84662	SVOC		X	
2,4-Dimethylphenol	105679	SVOC		X	
Dimethylphthalate	131113	SVOC		X	
Di-n-butylphthalate	84742	SVOC	X		
Di-n-octylphthalate	117840	SVOC	X		
4,6-Dinitro-2-methylphenol	534521	SVOC		X	
2,4-Dinitrophenol	51285	SVOC		X	
2,4-Dinitrotoluene	121142	SVOC		X	
2,6-Dinitrotoluene	606202	SVOC		X	
Endosulfan I	115297	PEST		X[9]	
Endosulfan II	115297	PEST		X[9]	
Endosulfan sulfate	1031078	PEST			X (endosulfan)

TABLE 1

SOURCE OF CONNECTICUT REMEDIATION STANDARDS
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NEW LONDON, GROTON, CONNECTICUT

Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
Endrin	72208	PEST	X		
Endrin aldehyde	7421363	PEST			X (endrin)
Endrin ketone	53494705	PEST			X (endrin)
Ethylbenzene	100414	VOC	X		
Fluoranthene	206440	SVOC	X		
Fluorene	86737	SVOC	X		
Heptachlor	76448	PEST	X		
Heptachlor epoxide	1024573	PEST	X		
Hexachlorobenzene	118741	SVOC	X		
Hexachlorobutadiene	87683	SVOC		X	
Hexachlorocyclopentadiene	77474	SVOC		X	
Hexachloroethane	67721	SVOC	X		
2-Hexanone	73663715	VOC		X	
Indeno(1,2,3-cd)pyrene	193395	SVOC		X	
Iron	7439896	INORG	[4]	[4]	[4]
Isophorone	78591	SVOC		X	
Lead	7439291	INORG	X		
Magnesium	7439954	INORG	[6]	[6]	[6]
Manganese	7439965	INORG		X	
Mercury	7439976	INORG	X		
Methoxychlor	72435	PEST	X		
Methylene chloride	75092	VOC	X		
2-Methylnaphthalene	91576	SVOC		X	
4-Methyl-2-pentanone	108101	VOC	X		
2-Methylphenol	95487	SVOC		X	
4-Methylphenol	106445	SVOC		X	
Naphthalene	91203	SVOC	X		
Nickel	7440020	INORG	X		
2-Nitroaniline	88744	SVOC		X	
3-Nitroaniline	99092	SVOC		X	
4-Nitroaniline	100016	SVOC		X	
Nitrobenzene	98953	SVOC		X	
2-Nitrophenol	88755	SVOC			X (4-nitrophenol)
4-Nitrophenol	100027	SVOC		X	
N-Nitrosodiphenylamine	86306	SVOC		X	
N-Nitrosodi-n-propylamine	621647	SVOC		X	
2,2'-Oxybis(1-chloropropane)	108601	SVOC	[5]	[5]	[5]
Pentachlorophenol	87865	SVOC	X		
Phenanthrene	85018	SVOC			X (naphthalene)
Phenol	108952	SVOC	X		
Potassium	7440097	INORG	[6]	[6]	[6]
Pyrene	129000	SVOC	X		

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NEW LONDON, GROTON, CONNECTICUT

Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
Selenium	7782492	INORG	X		
Silver	7440224	INORG	X		
Sodium	7440235	INORG	[6]	[6]	[6]
Styrene	100425	VOC	X		
1,1,2,2-Tetrachloroethane	79345	VOC	X		
Tetrachloroethylene	127184	VOC	X		
Thallium	6533739	INORG	X		
Toluene	108883	VOC	X		
Toxaphene	8001352	PEST	X		
1,2,4-Trichlorobenzene	120821	SVOC		X	
1,1,1-Trichloroethane	71556	VOC	X		
1,1,2-Trichloroethane	79005	VOC	X		
Trichloroethylene	79016	VOC	X		
2,4,5-Trichlorophenol	95954	SVOC		X	
2,4,6-Trichlorophenol	88062	SVOC		X	
Vanadium	7440622	INORG	X		
Vinyl chloride	75014	VOC	X		
Xylene (total)	1330207	VOC	X		
Zinc	7440666	INORG	X		

INORG Inorganic
PEST Pesticide
SVOC Semivolatile organic compound
VOC Volatile organic compound

1 State of Connecticut Remediation Standard Regulations, Section 22a-133k (January 1996).
2 Published toxicity criteria is available. Toxicity criteria from the current USEPA Region III Risk-Based Concentration Table (October 22, 1997) will be used to calculate a value using the methodology presented in the State guidance (January 1996).
3 No toxicity criteria is available. Toxicity criteria for a similarly structured chemical (noted in parentheses) will be used to calculate a value.
4 Region I does not advocate a quantitative evaluation of this chemical. Exposure to this chemical will be addressed in a qualitative fashion.
5 No promulgated value or published toxicity criteria are available. A similarly structured chemical with published toxicity criteria could not be identified. Exposure to this chemical will be addressed in a qualitative fashion.
6 Chemical is an essential nutrient.
7 Value for chlordane is used.
8 Value for hexavalent chromium is used for conservative purposes.
9 Value for endosulfan is used.

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SOURCE OF CONNECTICUT REMEDIATION STANDARDS
CTO 260 LOWER SUBASE RI
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Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
Acenaphthene	83329	SVOC		X	
Acenaphthylene	208968	SVOC	X		
Anthracene	120127	SVOC	X		
Acetone	67641	VOC	X		
Aldrin	309002	PEST		X	
Aluminum	7429905	INORG	[4]	[4]	[4]
Antimony	7440360	INORG	X		
Arsenic	7440382	INORG	X		
Barium	7440393	INORG	X		
Benzene	71432	VOC	X		
Benz(a)anthracene	56553	SVOC	X		
Benzo(b)fluoranthene	205992	SVOC	X		
Benzo(k)fluoranthene	207089	SVOC	X		
Benzo(g,h,i)perylene	191242	SVOC			X (pyrene)
Benzo(a)pyrene	50328	SVOC	X		
Beryllium	7440417	INORG	X		
BCH (alpha-)	319846	PEST		X	
BCH (beta-)	319857	PEST		X	
BCH (delta-)	319868	PEST			X (alpha-BHC)
BCH (gamma-; Lindane)	58899	PEST	X		
Bis(2-chloroethoxy)methane	111911	SVOC	[5]	[5]	[5]
Bis(2-chloroethyl)ether	111444	SVOC	X		
Bis(2-ethylhexyl)phthalate	117817	SVOC	X		
Bromochloromethane	74975	VOC			X (bromodichloro-methane)
Bromodichloromethane	75274	VOC		X	
Bromoform	75252	VOC	X		
Bromomethane	74839	VOC		X	
4-Bromophenyl-phenylether	101553	SVOC		X	
2-Butanone	78933	VOC	X		
Butylbenzylphthalate	85687	SVOC	X		
Cadmium	7440439	INORG	X		
Calcium	7440702	INORG	[6]	[6]	[6]
Carbazole	86748	SVOC		X	
Carbon disulfide	75150	VOC		X	
Carbon tetrachloride	56235	VOC	X		
Chlordane (alpha-)	57749	PEST	X[7]		
Chlordane (gamma-)	57749	PEST	X[7]		
4-Chloroaniline	106478	SVOC		X	
Chlorobenzene	108907	VOC	X		
Chlorodibromomethane	124481	VOC	X		
Chloroethane	75003	VOC		X	
Chloroform	67663	VOC	X		
Chloromethane	74873	VOC		X	
4-Chloro-3-methylphenol	59507	SVOC	[5]	[5]	[5]

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Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
2-Chloronaphthalene	91587	SVOC		X	
2-Chlorophenol	95578	SVOC	X		
4-Chlorophenyl-phenylether	7005723	SVOC			X (4-Bromophenyl-phenylether)
Chromium (total)		INORG	X[5]		
Chrysene	218019	SVOC		X	
Cobalt	7440484	INORG		X	
Copper	7440508	INORG	[4]	[4]	[4]
4,4'-DDD	72548	PEST		X	
4,4'-DDE	72559	PEST		X	
4,4'-DDT	50293	PEST		X	
Dibenzofuran	132649	SVOC		X	
Dibenz(a,h)anthracene	53703	SVOC		X	
1,2-Dibromo-3-chloropropane	96128	VOC		X	
1,2-Dibromoethane	106934	VOC		X	
1,2-Dichlorobenzene	95501	VOC/SVOC	X		
1,3-Dichlorobenzene	541731	VOC/SVOC	X		
1,4-Dichlorobenzene	106467	VOC/SVOC	X		
3,3'-Dichlorobenzidine	91941	SVOC		X	
1,1-Dichloroethane	75343	VOC	X		
1,2-Dichloroethane	107062	VOC	X		
1,1-Dichloroethene	75354	VOC	X		
1,2-Dichloroethene (cis-)	156592	VOC	X		
1,2-Dichloroethene (trans-)	156605	VOC	X		
1,2-Dichloroethene (total)	156605	VOC		X	
2,4-Dichlorophenol	120832	SVOC	X		
1,2-Dichloropropane	78875	VOC	X		
1,3-Dichloropropene (cis-)	542756	VOC	X		
1,3-Dichloropropene (trans-)	542756	VOC	X		
Dieldrin	60571	PEST	X		
Diethyl phthalate	84662	SVOC		X	
2,4-Dimethylphenol	105679	SVOC		X	
Dimethylphthalate	131113	SVOC		X	
Di-n-butylphthalate	84742	SVOC	X		
Di-n-octylphthalate	117840	SVOC	X		
4,6-Dinitro-2-methylphenol	534521	SVOC		X	
2,4-Dinitrophenol	51285	SVOC		X	
2,4-Dinitrotoluene	121142	SVOC		X	
2,6-Dinitrotoluene	606202	SVOC		X	
Endosulfan I	115297	PEST		X[9]	
Endosulfan II	115297	PEST		X[9]	
Endosulfan sulfate	1031078	PEST			X (endosulfan)
Endrin	72208	PEST	X		
Endrin aldehyde	7421363	PEST			X (endrin)
Endrin ketone	53494705	PEST			X (endrin)

TABLE 1

SOURCE OF CONNECTICUT REMEDIATION STANDARDS
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT
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Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
Ethylbenzene	100414	VOC	X		
Fluoranthene	206440	SVOC	X		
Fluorene	86737	SVOC	X		
Heptachlor	76448	PEST	X		
Heptachlor epoxide	1024573	PEST	X		
Hexachlorobenzene	118741	SVOC	X		
Hexachlorobutadiene	87683	SVOC		X	
Hexachlorocyclopentadiene	77474	SVOC		X	
Hexachloroethane	67721	SVOC	X		
2-Hexanone	73663715	VOC		X	
Indeno(1,2,3-cd)pyrene	193395	SVOC		X	
Iron	7439896	INORG	[4]	[4]	[4]
Isophorone	78591	SVOC		X	
Lead	7439291	INORG	X		
Magnesium	7439954	INORG	[6]	[6]	[6]
Manganese	7439965	INORG		X	
Mercury	7439976	INORG	X		
Methoxychlor	72435	PEST	X		
Methylene chloride	75092	VOC	X		
2-Methylnaphthalene	91576	SVOC		X	
4-Methyl-2-pentanone	108101	VOC	X		
2-Methylphenol	95487	SVOC		X	
4-Methylphenol	106445	SVOC		X	
Naphthalene	91203	SVOC	X		
Nickel	7440020	INORG	X		
2-Nitroaniline	88744	SVOC		X	
3-Nitroaniline	99092	SVOC		X	
4-Nitroaniline	100016	SVOC		X	
Nitrobenzene	98953	SVOC		X	
2-Nitrophenol	88755	SVOC			X (4-nitrophenol)
4-Nitrophenol	100027	SVOC		X	
N-Nitrosodiphenylamine	86306	SVOC		X	
N-Nitrosodi-n-propylamine	621647	SVOC		X	
2,2'-Oxybis(1-chloropropane)	108601	SVOC	[5]	[5]	[5]
Pentachlorophenol	87865	SVOC	X		
Phenanthrene	85018	SVOC	X		
Phenol	108952	SVOC	X		
Potassium	7440097	INORG	[6]	[6]	[6]
Pyrene	129000	SVOC	X		
Selenium	7782492	INORG	X		
Silver	7440224	INORG	X		
Sodium	7440235	INORG	[6]	[6]	[6]
Styrene	100425	VOC	X		
1,1,2,2-Tetrachloroethane	79345	VOC	X		
Tetrachloroethylene	127184	VOC	X		
Thallium	6533739	INORG	X		
Toluene	108883	VOC	X		
Toxaphene	8001352	PEST	X		

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PAGE 4 OF 4

Chemical	CAS Number	Chemical Fraction	Basis of Value to be Used in RI Report		
			Promulgated Value[1]	Calculated Value[2]	Surrogate Calculated Value[3]
1,2,4-Trichlorobenzene	120821	SVOC		X	
1,1,1-Trichloroethane	71556	VOC	X		
1,1,2-Trichloroethane	79005	VOC	X		
Trichloroethylene	79016	VOC	X		
2,4,5-Trichlorophenol	95954	SVOC		X	
2,4,6-Trichlorophenol	88062	SVOC		X	
Vanadium	7440622	INORG	X		
Vinyl chloride	75014	VOC	X		
Xylene (total)	1330207	VOC	X		
Zinc	7440666	INORG	X		

INORG Inorganic
PEST Pesticide
SVOC Semivolatile organic compound
VOC Volatile organic compound

1 State of Connecticut Remediation Standard Regulations, Section 22a-133k (January 1996).
2 Published toxicity criteria is available. Toxicity criteria from the current USEPA Region III Risk-Based Concentration Table (October 22, 1997) will be used to calculate a value using the methodology presented in the State guidance (January 1996).
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4 Region I does not advocate a quantitative evaluation of this chemical. Exposure to this chemical will be addressed in a qualitative fashion.
5 No promulgated value or published toxicity criteria are available. A similarly structured chemical with published toxicity criteria could not be identified. Exposure to this chemical will be addressed in a qualitative fashion.
6 Chemical is an essential nutrient.
7 Value for chlordane is used.
8 Value for hexavalent chromium is used for conservative purposes.
9 Value for endosulfan is used.

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	Published Toxicological Criteria[1]		Calculated Remediation Standards[2]				
			Soil (mg/kg)				Groundwater (ug/L)
	RfD_{oral} (mg/kg/day)	CSF_{oral} (kg/day/mg)	RES DE[3]	I/C DE[3]	GA/GAA PM	GB PM	GA/GAA GP
Acenaphthene	6.00E-02	NA	1000[4]	2500[4]	8.4	84	420
Aldrin	3.00E-05	1.70E+01	0.036	0.34	0.000041	0.00041	0.0021
Benzo(g,h,i)perylene	NA	NA	1000[5]	2500[5]	5.6[5]	56[5]	280[5]
BCH (alpha-)	NA	6.30E+00	0.097	0.91	0.00011	0.0011	0.0056
BCH (beta-)	NA	1.80E+00	0.34	3.2	0.00039	0.0039	0.0194
BCH (delta-)	NA	NA	0.097[6]	0.91[6]	0.00011[6]	0.0011[6]	0.0056[6]
Bromochloromethane	NA	NA	47[7]	440[7]	0.054[7]	0.54[7]	2.7[7]
Bromodichloromethane	2.00E-02	6.20E-02	9.9	92	0.011	0.11	0.56
Bromomethane	1.40E-03	NA	95	1000[4]	0.2	2	9.8
4-Bromophenyl-phenylether	5.80E-02	NA	500[4]	1000[4]	8.2	82	410
Carbazole	NA	2.00E-02	31	290	0.036	0.36	1.8
Carbon disulfide	1.00E-01	NA	500[4]	1000[4]	14	140	700
4-Chloroaniline	4.00E-03	NA	270	2500[4]	0.56	5.6	28
Chloroethane	4.00E-01	2.90E-03	210	1000[4]	0.24	2.4	12
Chloromethane	NA	1.30E-02	47	440	0.054	0.54	2.7
4-Chloro-3-methylphenol	NA	NA	1000[8]	2500[8]	7[8]	70[8]	350[8]
2-Chloronaphthalene	8.00E-02	NA	1000[4]	2500[4]	11	110	560
4-Chlorophenyl-phenylether	NA	NA	500[9]	1000[9]	8.2[9]	82[9]	410[9]
Chrysene	NA	7.30E-03	84	780	0.096	0.96	4.8
Cobalt	6.00E-02	NA	1000[4]	2500[4]	2200[10][11]	22000[10][11]	420
4,4'-DDD	NA	2.40E-01	2.6	24	0.0029	0.029	0.15
4,4'-DDE	NA	3.40E-01	1.8	17	0.0021	0.021	0.1
4,4'-DDT	5.00E-04	3.40E-01	1.8	17	0.0021	0.021	0.1
Dibenzofuran	4.00E-03	NA	270	2500[4]	0.56	5.6	28
Dibenz(a,h)anthracene	NA	7.30E+00	0.084	0.78	0.000096	0.00096	0.0048
1,2-Dibromo-3-chloropropane	NA	1.40E+00	0.44	4.1	0.0005	0.005	0.025
1,2-Dibromoethane	NA	8.50E+01	0.0072	0.067	0.0000082	0.000082	0.00041
3,3'-Dichlorobenzidine	NA	4.50E-01	1.4	13	0.0016	0.016	0.078
1,2-Dichloroethene (total)	2.00E-02	NA	500[4]	1000[4]	2.8	28	140
Diethyl phthalate	8.00E-01	NA	1000[4]	2500[4]	110	1100	5600

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	Published Toxicological Criteria[1]		Calculated Remediation Standards[2]				
	RfD_{oral} (mg/kg/day)	CSF_{oral} (kg/day/mg)	Soil (mg/kg)				Groundwater (ug/L)
			RES DE[3]	I/C DE[3]	GA/GAA PM	GB PM	GA/GAA GP
2,4-Dimethylphenol	2.00E-02	NA	1000[4]	2500[4]	2.8	28	140
Dimethylphthalate	1.00E+01	NA	1000[4]	2500[4]	1400	1400	70000
4,6-Dinitro-2-methylphenol	1.00E-04	NA	6.8	200	0.014	0.14	0.7
2,4-Dinitrophenol	2.00E-03	NA	140	2500[4]	0.28	2.8	14
2,4-Dinitrotoluene	2.00E-03	NA	140	2500[4]	0.28	2.8	14
2,6-Dinitrotoluene	1.00E-03	NA	68	2000	0.14	1.4	7
Endosulfan I	6.00E-03	NA	410	1200	0.84	8.4	42
Endosulfan II	6.00E-03	NA	410	1200	0.84	8.4	42
Endosulfan sulfate	NA	NA	410[12]	1200[12]	0.84[12]	8.4[12]	42[12]
Endrin aldehyde	NA	NA	20[13]	610[13]	NE[13]	NE[13]	NE[13]
Endrin ketone	NA	NA	20[13]	610[13]	NE[13]	NE[13]	NE[13]
Hexachlorobutadiene	2.00E-04	7.80E-02	7.9	73	0.009	0.09	0.45
Hexachlorocyclopentadiene	7.00E-03	NA	470	2500[4]	0.98	9.8	49
2-Hexanone	4.00E-02	NA	500[4]	1000[4]	5.6	56	280
Indeno(1,2,3-cd)pyrene	NA	7.30E-01	0.84	7.8	0.00096	0.0096	0.045
Isophorone	2.00E-01	9.50E-04	640	2500[4]	0.74	7.4	37
Manganese	2.30E-02	NA	1600	47000	50[10][14]	500[10][14]	160
2-Methylnaphthalene	4.00E-02	NA	1000[4]	2500[4]	5.6	56	280
2-Methylphenol	5.00E-02	NA	1000[4]	2500[4]	7	70	350
4-Methylphenol	5.00E-03	NA	340	2500[4]	0.7	7	35
2-Nitroaniline	6.00E-05	NA	4.1	1200	0.0084	0.084	0.42
3-Nitroaniline	3.00E-03	NA	200	2500[4]	0.42	4.2	21
4-Nitroaniline	3.00E-03	NA	200	2500[4]	0.42	4.2	21
Nitrobenzene	5.00E-04	NA	34	1000	0.07	0.7	3.5
2-Nitrophenol	NA	NA	540[15]	2500[15]	1.1[15]	11[15]	56[15]
4-Nitrophenol	8.00E-03	NA	540	2500[4]	1.1	11	56
N-Nitrosodiphenylamine	NA	4.90E-03	130	1200	0.14	1.4	7.1
N-Nitrosodi-n-propylamine	NA	7.00E+00	0.088	0.82	0.0001	0.001	0.005
Phenanthrene	NA	NA	1000[5]	2500[5]	5.6[5]	56[5]	280[5]
1,2,4-Trichlorobenzene	1.00E-02	NA	680	2500[4]	1.4	14	70

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	Published Toxicological Criteria[1]		Calculated Remediation Standards[2]				
	RfD_{oral} (mg/kg/day)	CSF_{oral} (kg/day/mg)	Soil (mg/kg)				Groundwater (ug/L)
			RES DE[3]	I/C DE[3]	GA/GAA PM	GB PM	GA/GAA GP
2,4,5-Trichlorophenol	1.00E-01	NA	1000[4]	2500[4]	14	140	700
2,4,6-Trichlorophenol	NA	1.10E-02	56	520	0.064	0.64	3.2

RfD	Reference dose
CSF	Cancer slope factor
RES DE	Direct exposure criteria for residential land use
I/C DE	Direct exposure criteria for industrial/commercial land use.
GA/GAA PM	Pollutant mobility criteria for a GA/GAA classified area
GB PM	Pollutant mobility criteria for a GB classified area
GA/GAA GP	Groundwater protection criteria for a GA/GAA classified area
NA	Not available
NE	None established by Connecticut DEP (January 1996)

1 Values obtained from current USEPA Region III Risk-Based Concentration Table (October 22, 1997)
2 Calculated using methodologies presented in State guidance (January 1996).
3 Calculated value for direct exposure for volatile and semivolatile organics is replaced with the appropriate ceiling limit if the calculated value exceeds the ceiling limit. Ceiling limit for volatiles is 500 mg/kg for residential exposure and 1000 mg/kg for industrial/commercial exposure. Ceiling limit for semivolatiles is 1000 mg/kg for residential exposure and 2500 mg/kg for industrial/commercial exposure
4 Ceiling limit. Calculated value exceeds the ceiling limit.
5 Value for naphthalene is used.
6 Value for alpha-BHC is used.
7 Value for chloromethane is used.
8 Value for 3-methylphenol is used.
9 Value for 4-bromophenyl-phenylether is used.
10 Value is for aqueous units (ug/L) and is based on SPLP or TCLP analytical results.
11 Value is based on the Region III RBC for tap water (2200 ug/L).
12 Value for endosulfan is used.
13 Value for endrin is used.
14 Value is based on the secondary Federal MCL for drinking water (50 ug/L).
15 Value for 4-nitrophenol is used.

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	Published Toxciological Criteria[1]		Calculated Remediation Standards[2]				
	RfD_{oral} (mg/kg/day)	CSF_{oral} (kg/day/mg)	Soil (mg/kg)				Groundwater (ug/L)
			RES DE[3]	I/C DE[3]	GA/GAA PM	GB PM	GA/GAA GP
Acenaphthene	6.00E-02	NA	1000[4]	2500[4]	8.4	84	420
Aldrin	3.00E-05	1.70E+01	0.036	0.34	0.000041	0.00041	0.0021
Benzo(g,h,i)perylene	NA	NA	1000[5]	2500[5]	4[5]	40[5]	200[5]
BCH (alpha-)	NA	6.30E+00	0.097	0.91	0.00011	0.0011	0.0056
BCH (beta-)	NA	1.80E+00	0.34	3.2	0.00039	0.0039	0.0194
BCH (delta-)	NA	NA	0.097[6]	0.91[6]	0.00011[6]	0.0011[6]	0.0056[6]
Bromochloromethane	NA	NA	9.9[7]	92[7]	0.011[7]	0.11[7]	0.56[7]
Bromodichloromethane	2.00E-02	6.20E-02	9.9	92	0.011	0.11	0.56
Bromomethane	1.40E-03	NA	95	1000[4]	0.2	2	9.8
4-Bromophenyl-phenylether	5.80E-02	NA	500[4]	1000[4]	8.2	82	410
Carbazole	NA	2.00E-02	31	290	0.036	0.36	1.8
Carbon disulfide	1.00E-01	NA	500[4]	1000[4]	14	140	700
4-Chloroaniline	4.00E-03	NA	270	2500[4]	0.56	5.6	28
Chloroethane	4.00E-01	2.90E-03	210	1000[4]	0.24	2.4	12
Chloromethane	NA	1.30E-02	47	440	0.054	0.54	2.7
4-Chloro-3-methylphenol	NA	NA	NA[8]	NA[8]	NA[8]	NA[8]	NA[8]
2-Chloronaphthalene	8.00E-02	NA	1000[4]	2500[4]	11	110	560
4-Chlorophenyl-phenylether	NA	NA	500[9]	1000[9]	8.2[9]	82[9]	410[9]
Chrysene	NA	7.30E-03	84	780	0.096	0.96	4.8
Cobalt	6.00E-02	NA	1000[4]	2500[4]	420[10]	4200[10]	420
4,4'-DDD	NA	2.40E-01	2.6	24	0.0029	0.029	0.15
4,4'-DDE	NA	3.40E-01	1.8	17	0.0021	0.021	0.1
4,4'-DDT	5.00E-04	3.40E-01	1.8	17	0.0021	0.021	0.1
Dibenzofuran	4.00E-03	NA	270	2500[4]	0.56	5.6	28
Dibenz(a,h)anthracene	NA	7.30E+00	0.084	0.78	0.000096	0.00096	0.0048
1,2-Dibromo-3-chloropropane	NA	1.40E+00	0.44	4.1	0.0005	0.005	0.025
1,2-Dibromoethane	NA	8.50E+01	0.0072	0.067	0.0000082	0.000082	0.00041
3,3'-Dichlorobenzidine	NA	4.50E-01	1.4	13	0.0016	0.016	0.078
1,2-Dichloroethene (total)	9.00E-03	NA	500[4]	1000[4]	1.2	12	63
Diethyl phthalate	8.00E-01	NA	1000[4]	2500[4]	110	1100	5600
2,4-Dimethylphenol	2.00E-02	NA	1000[4]	2500[4]	2.8	28	140
Dimethylphthalate	1.00E+01	NA	1000[4]	2500[4]	1400	14000	70000

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 280 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

Chemical	Published Toxicological Criteria[1]		Calculated Remediation Standards[2]				
			Soil (mg/kg)				Groundwater (ug/L)
	RfD_{oral} (mg/kg/day)	CSF_{oral} (kg/day/mg)	RES DE[3]	I/C DE[3]	GA/GAA PM	GB PM	GA/GAA GP
4,6-Dinitro-2-methylphenol	1.00E-04	NA	6.8	200	0.014	0.14	0.7
2,4-Dinitrophenol	2.00E-03	NA	140	2500[4]	0.28	2.8	14
2,4-Dinitrotoluene	2.00E-03	NA	140	2500[4]	0.28	2.8	14
2,6-Dinitrotoluene	1.00E-03	NA	68	2000	0.14	1.4	7
Endosulfan I	6.00E-03	NA	410	1200	0.84	8.4	42
Endosulfan II	6.00E-03	NA	410	1200	0.84	8.4	42
Endosulfan sulfate	NA	NA	410[12]	1200[12]	0.84[12]	8.4[12]	42[12]
Endrin aldehyde	NA	NA	20[13]	610[13]	NE[13]	NE[13]	NE[13]
Endrin ketone	NA	NA	20[13]	610[13]	NE[13]	NE[13]	NE[13]
Hexachlorobutadiene	2.00E-04	7.80E-02	7.9	73	0.009	0.09	0.45
Hexachlorocyclopentadiene	7.00E-03	NA	470	2500[4]	0.98	9.8	49
2-Hexanone	4.00E-02	NA	500[4]	1000[4]	5.6	56	280
Indeno(1,2,3-cd)pyrene	NA	7.30E-01	0.84	7.8	0.00096	0.0096	0.045
Isophorone	2.00E-01	9.50E-04	640	2500[4]	0.74	7.4	37
Manganese	2.30E-02	NA	1600	47000	50[10][14]	500[10][14]	160
2-Methylnaphthalene	4.00E-02	NA	1000[4]	2500[4]	5.6	56	280
2-Methylphenol	5.00E-02	NA	1000[4]	2500[4]	7	70	350
4-Methylphenol	5.00E-03	NA	340	2500[4]	0.7	7	35
2-Nitroaniline	6.00E-05	NA	4.1	1200	0.0084	0.084	0.42
3-Nitroaniline	3.00E-03	NA	200	2500[4]	0.42	4.2	21
4-Nitroaniline	3.00E-03	NA	200	2500[4]	0.42	4.2	21
Nitrobenzene	5.00E-04	NA	34	1000	0.07	0.7	3.5
2-Nitrophenol	NA	NA	540[15]	2500[15]	1.1[15]	11[15]	56[15]
4-Nitrophenol	8.00E-03	NA	540	2500[4]	1.1	11	56
N-Nitrosodiphenylamine	NA	4.90E-03	130	1200	0.14	1.4	7.1
N-Nitrosodi-n-propylamine	NA	7.00E+00	0.088	0.82	0.0001	0.001	0.005
1,2,4-Trichlorobenzene	1.00E-02	NA	680	2500[4]	1.4	14	70
2,4,5-Trichlorophenol	1.00E-01	NA	1000[4]	2500[4]	14	140	700
2,4,6-Trichlorophenol	NA	1.10E-02	56	520	0.064	0.64	3.2

RfD Reference dose
CSF Cancer slope factor

TABLE 2

CALCULATED AND SURROGATE CALCULATED VALUES
CTO 260 LOWER SUBASE RI
NEW LONDON, GROTON, CONNECTICUT

RES DE	Direct exposure criteria for residential land use
I/C DE	Direct exposure criteria for industrial/commercial land use.
GA/GAA PM	Pollutant mobility criteria for a GA/GAA classified area
GB PM	Pollutant mobility criteria for a GB classified area
GA/GAA GP	Groundwater protection criteria for a GA/GAA classified area
NA	Not available
NE	None established by Connecticut DEP (January 1996)

1 Values obtained from current USEPA Region III Risk-Based Concentration Table (October 22, 1997)
2 Calculated using methodologies presented in State guidance (January 1996).
3 Calculated value for direct exposure for volatile and semivolatile organics is replaced with the appropriate ceiling limit if the calculated value exceeds the ceiling limit. Ceiling limit for volatiles is 500 mg/kg for residential exposure and 1000 mg/kg for industrial/commercial exposure. Ceiling limit for semivolatiles is 1000 mg/kg for residential exposure and 2500 mg/kg for industrial/commercial exposure.
4 Ceiling limit. Calculated value exceeds the ceiling limit.
5 Value for pyrene is used.
6 Value for alpha-BHC is used.
7 Value for bromodichloromethane is used.
8 Chemical will be addressed qualitatively at CTEP's request
9 Value for 4-bromophenyl-phenylether is used.
10 Value is for aqueous units (ug/L) and is based on SPLP or TCLP analytical results.
11 Value is based on the Region III RBC for tap water (2200 ug/L).
12 Value for endosulfan is used.
13 Value for endrin is used.
14 Value is based on the secondary Federal MCL for drinking water (50 ug/L).
15 Value for 4-nitrophenol is used.

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C-49-03-8-156

March 20, 1998

Brown & Root Environmental Project Number 7237

Mr. Mark Lewis
Connecticut Department of Environmental Protection
Water Management Bureau
Permitting, Enforcement, and Remediation Division
Federal Remediation Program
79 Elm Street
Hartford, Connecticut 06106-5127

Reference: CLEAN Contract No. N62472-90-D-1298
Contract Task Order No. 0260

Subject: Responses to CTDEP's Comments on Calculated Remediation Standards
Lower Subase Remedial Investigation
Naval Submarine Base - New London, Groton, Connecticut

Dear Mr. Lewis:

Brown & Root (B&R) Environmental and the Navy received your February 27, 1998 comment letter regarding the Remediation Standards that were calculated for use in the Lower Subase Remedial Investigation. Responses to CTDEP's comments have been prepared and the appropriate revisions have been made to Tables 1 and 2, which were previously enclosed in B&R Environmental's December 23, 1997 letter. B&R Environmental, on the behalf of the United States Navy, Northern Division Facilities Engineering Command and Naval Submarine Base - New London, has enclosed the Navy's responses to CTDEP's comments and the revised tables for your review and approval.

If you have any questions regarding the responses or the information provided in the revised tables, please contact Mr. Mark Evans at (610) 595-0567 (ext. 162) or me at (412) 921-8244. It is anticipated that any remaining issues can be resolved during a conference call.

Very truly yours,

Corey A. Rich, P.E.
Project Manager

Enclosure(s)

c: Mr. Roger Boucher, NORTHDIV (letter only)
Mr. Mark Evans, NORTHDIV
Mr. Andy Stackpole, NSB-NLON Environmental
Mr. John Trepanowski, B&R Environmental
Mr. Daryl Hutson, B&R Environmental (letter only)
Ms. Karen Smecker, B&R Environmental
File: CTO 0260

RESPONSES TO CTDEP'S COMMENTS (2/27/98)
ON THE CALCULATED CTDEP REMEDIATION STANDARDS (12/23/97)
CTO 260 - LOWER SUBASE REMEDIAL INVESTIGATION
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT
MARCH 20, 1998

I. SURROGATE CHEMICALS USED TO SUPPLY TOXICITY VALUES

Comment:

1. **The Navy has used naphthalene as a surrogate to represent the toxicity of benzo(g,h,I)perylene. As noted in Dr. Ginsberg's memorandum, pyrene (RfD 0.03 mg/kg/d) is a more appropriate surrogate. The RfD for naphthalene has been withdrawn from IRIS. Please recalculate the direct exposure, pollutant mobility, and ground water protection criteria for benzo(g,h,i)perylene using this approach. This approach is appropriate for a screening level risk assessment. However, the uncertainties involved with this approach should be acknowledged if these two chemicals are found to be major risk drivers at the site.**

Response:

The direct exposure, pollutant mobility, and groundwater protection criteria for benzo(g,h,i)perylene will be recalculated using pyrene as a surrogate. Benzo(g,h,i)perylene was detected in soil and groundwater at the Lower Subase but was not found to be a major risk driver at any of the zones that were evaluated in the risk assessment. Benzo(g,h,i)perylene was only identified as a COC in groundwater at Zone 4 where it was detected in one sample at a concentration exceeding the State's Ambient Water Quality Criteria (AWQC) for the protection of human health. Consequently, this does not have any impact on the human health risk assessment.

Comment:

2. **It is unclear why the Navy calculated criteria for phenanthrene since the regulations list direct exposure, pollutant mobility, and groundwater protection criteria for this compound. Please use the criteria listed in the Regulations for this compound. The Navy should either withdraw their request for approval of criteria for phenanthrene, or, if the Navy is requesting approval of alternative criteria for this compound under the Regulations, the Navy should so state.**

Response:

The Navy retracts its request for approval of criteria for phenanthrene. The promulgated criteria for phenanthrene were used in the selection of COCs in the human health risk assessment. Consequently, this does not have any impact on the human health risk assessment.

Comment:

3. **Bromodichloromethane should be used as a surrogate for bromochloromethane. Please use the criteria calculated for bromodichloromethane in place of those calculated using chloromethane as a surrogate.**

Response:

Bromodichloromethane will be used as a surrogate for bromochloromethane. Bromodichloromethane was not detected in soil and groundwater samples for any of the zones evaluated in the human health risk assessment, consequently this does not have any impact on the analysis.

Comment:

4. **The Navy's proposal to use 3-methylphenol as a surrogate for 4-chloro-3-methylphenol is not appropriate, due to structural differences between the two compounds. The use of a qualitative risk assessment would be acceptable assuming that concentrations of this chemical do not exceed the low part-per-billion range. Please see Dr. Ginsberg's comments for additional details.**

Response:

No criteria will be developed for 4-chloro-3-methylphenol. Instead, as suggested, 4-chloro-3-methylphenol will be evaluated qualitatively. 4-Chloro-3-methylphenol was only detected in one soil sample at the Lower Subase and at a low concentration (34 ppb), consequently, this does not have any impact on the human health risk assessment.

II. INCORRECT OR UNSUPPORTED POTENCY VALUES

Comment:

5. **Several of the CSFs or RfDs used by the Navy appeared to be incorrect, based on a comparison to the values listed in the EPA Region III Risk Based Concentrations table, IRIS, or HEAST. Please recalculate the direct exposure, pollutant mobility, and ground water protection criteria using correct values for total 1,2-dichloroethene. Please assume that this value pertains to the mixture of *cis* and *trans* isomers. The RfD for the mixture should be 9E-3 mg/kg/d.**

Response:

The direct exposure, pollutant mobility, and groundwater protection criteria for total 1.2-dichloroethene will be recalculated using an oral reference dose of 9E-3 mg/kg/day. This revision does not impact the human health risk assessment since all detected concentrations of total 1.2-dichloroethene are less than the recalculated criteria.

Comment:

6. **The Department was unable to verify the potency factors listed by the Navy for several chemicals. Please either provide references to support the listed potency factors, or derive criteria using acceptable surrogates for the following compounds: chloroethane, 4,6-dinitro-2-methylphenol, 2-hexanone, and 2-methylnaphthalene. Please note that naphthalene is not an appropriate surrogate for 2-methylnaphthalene as the RfD for naphthalene has been withdrawn from IRIS. Please refer to Dr. Ginsberg's memo for additional guidance.**

Response:

The toxicity criteria for chloroethane, 4,6-dinitro-2-methylphenol, 2-hexanone, and 2-methylnaphthalene were obtained from the current U.S. EPA Region III Risk-based Concentration (RBC) Table dated October 22, 1997. The RBC table cites EPA's National Center for Environmental Assessment (NCEA) as the source for the values for chloroethane, 4,6-dinitro-2-methylphenol, and 2-methylnaphthalene. Although not cited in the RBC table, EPA Region III stated in telephone call on March 12, 1998, that NCEA is also the source for the toxicity criteria for 2-hexanone. Therefore, there are no changes necessary to the proposed values.

Comment:

7. **The Department was unable to verify the RfD listed by the Navy for 4-nitrophenol (8.00E-3 mg/kg/d). Please either provide a reference for the listed value, or use the default RfD currently listed in the RBC tables (6.2E-2 mg/kg/d).**

Response:

The current RBC table lists 8.00E-3 mg/kg/day as the oral RfD for 4-nitrophenol and cites EPA's NCEA as the source for the value. The value of 6.2E-2 mg/kg/day was listed in the previous, outdated version of the RBC table. Therefore, there are no changes necessary to the proposed criteria.

III. POLLUTANT MOBILITY CRITERIA FOR METALS

Comment:

8. **The ground water protection criterion for cobalt was calculated correctly by the Navy. However, the approach used by the Navy in calculating pollutant mobility criteria for cobalt is unacceptable. Rather than using the calculated ground water protection criterion (420 µg/l) to establish a pollutant mobility criterion for cobalt, the Navy used the EPA Region III Risk Based Criteria for tap water (2,200 µg/L) as the GAA/GA pollutant mobility criterion. This approach is less conservative than using the calculated ground water protection criterion. The correct pollutant mobility criteria for cobalt, based on the groundwater protection criteria calculated by the Navy, are 420 µg/L for a GAA/GA area, and 4,200 µg/L for a GB area (measurement by TCLP or SPLP).**

Response:

The pollutant mobility criteria for cobalt will be changed to 420 µg/L for a GAA/GA area and 4,200 µg/L for a GB area. This revision has no impact on the human health risk assessment because of the following reasons: (1) none of the historical soil samples that were analyzed by TCLP had leachates that were analyzed for cobalt, and (2) only the soil samples from Zone 6 had SPLP leachates that were analyzed for cobalt and all of the results were nondetects.

Comment:

9. **The ground water protection criterion for manganese was calculated correctly by the Navy. Rather than using the calculated ground water protection criterion (160 µg/l) to establish a pollutant mobility criterion for manganese, the Navy used the EPA Secondary MCL for drinking water (50 µg/L) as the GAA/GA pollutant mobility criterion. This approach is acceptable as it is more conservative than using the calculated ground water protection criterion.**

Response:

No response required.

IV. GB POLLUTANT MOBILITY CRITERIA FOR DIMETHYLPHTHALATE

Comment:

10. **The GB pollutant mobility criteria listed for dimethylphthalate (1,400 mg/kg) in the Navy's Table 2 appears to be a typo. The correct value should be listed as 14,000 mg/kg.**

Response:

The GB pollutant mobility criteria for dimethylphthalate will be corrected to 14,000 mg/kg. This revision has no impact on the analysis since dimethylphthalate was not detected in soil samples in any of the zones that were evaluated in the human health risk assessment.

V. BIS(2-CHLOROETHOXY)METHANE

Comment:

11. **The Navy proposes a qualitative risk assessment for this compound. This approach is acceptable provided that the compound is not present at concentrations above the low part-per-billion range. As noted by Dr. Ginsberg, if it is present above this range, a more quantitative risk assessment may be required.**

Response:

Bis(2-chloroethoxy)methane was not detected in soil or groundwater samples for any of the zones evaluated in the human health risk assessment. consequently this does not have any impact on the analysis.

Appendices F.3 to F.6
(pages 50-96)
are available
in a separate file (size: 4.3 MB)

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Appendix F.7
(pages 97-151)
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(pages 152-186)
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Appendices F.10 to F.12
(pages 265-340)
are available
in a separate file (size: 4.2 MB)

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